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THE BELL–BEUTTNER OPERATION WITH OVARIAN CONSERVATION OR GRAFTING[1]

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THE day when the greatness of a surgeon was judged by the rapidity with which he could amputate a limb has long vanished over the western horizon. So, also, I trust, will the time when the female genital organs are extirpated for comparatively innocuous lesions, soon fade into oblivion. Those of us in the old world who protest against ovarian and uterine nihilism, and are endeavouring to set an example of conservation of function—and there are many disciples of this faith among my younger colleagues in Great Britain—turn with hopeful eyes to America. We believe that such scientific idealism must surely appeal to the surgeons of a continent on which so much has been done, and is being done, to purify surgery and to lead practitioners of the surgical art to temper surgical justice with physiological mercy.

Can we not imagine such an one as John Hunter, with his profound interest in the relation of structure to function, if he lived today, leading a crusade of restraint? We, his successors, with our accumulated, and therefore intimate, knowledge of biology and pathology, should have only one thought, and that is how in every necessary operation not connected with malignant disease, we can ensure "the removal or treatment of diseased structures, without which the symptoms cannot be cured, with conservation as far as possible of function (5)."

I believe that the operation I am about to discuss is a measure that conforms with that principle, when used in properly selected cases. I wish particularly to emphasize the qualification "properly selected cases," for nothing brings disrepute upon surgical procedures so much as routine and ill-considered application.

RELATION OF THE CHARACTER OF THE LESIONS PRODUCED BY INFECTION TO THE OPERATIVE PROCEDURE ADOPTED

In ascending infections of the female genital tract, lesions may be produced throughout, from the external genitals to the pelvic peritoneum; and the character of these depends not only on the organism responsible for them, but also on the time of infection, especially in relation to menstruation, pregnancy, and the puerperium, and on the general resistance of the patient.

I do not think that it is necessary in this short communication to do more than to say, in regard to these matters, that some infective lesions of the genitalia tend to recover naturally, or are not difficult to cure by simple non-operative measures. Occasionally salpingostomy or pneumatic dilatation alone or combined with a modified Gilliam operation may suffice. This has been clearly demonstrated by the statistics of Holtz (8) and others.

The inflammatory lesions for which the Bell-Beuttner operation is indicated are those

[1]Read before the Clinical Congress of the American College of Surgeons, Philadelphia, October 26–31, 1925.

Fig. 1.

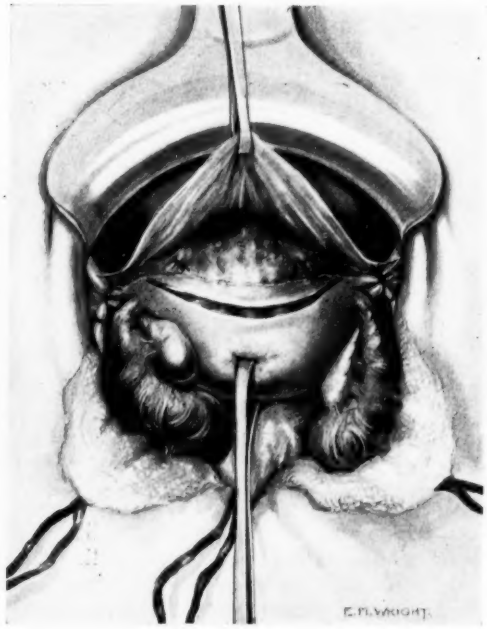

Fig. 2.

which cause irreparable damage of the tubes, and possibly ovaries, and affect the fundus uteri, but less severely. Such lesions are chiefly produced by the gonococcus. Streptococcus is usually less destructive for reasons I have discussed elsewhere (4, 5).

It is an essential condition that the infection be in the chronic stage at the time of operation (5).

In gonorrhœal cases it is often advisable for the surgeon to amputate or treat the cervix, in which the gonococcus finds an ideal habitation, before proceeding with the major operation; and this is especially necessary when that structure has been lacerated by childbirth.

Lesions of the fundus uteri due to infection cause menorrhagia or epimenorrhagia. The other symptoms from which the patient may seek relief are those associated with chronic salpingo-oophoritis—constitutional ill-health, dysmenorrhœa, dyspareunia, abdominal pain, and the rest.

In the absence of menorrhagia, the fundus is rarely found to be bulky and seriously infected, and in such cases it is sufficient to excise the pyosalpinges present, together with a wedge-shaped portion of the cornua uteri. If the uterus be retroverted it may be suspended in the way mentioned.

In other cases the whole uterus may be very badly affected, or the woman may be approaching the menopause, and in these circumstances hysterectomy with removal of the adnexa may be advisable.

It is remarkable in how many cases I have performed the minor or major procedures, reserving the intermediate operation—the Bell-Beuttner—for the lesions I have mentioned: namely, irremediable injuries of the tubes and ovaries with definite infection of the fundus uteri. In consequence of the care employed in the selection, my statistics do not comprise a large number of operations.

The question of conservation of the ovary in the normal position is not always an easy one to decide. There are those, I know, who never have any difficulty in settling the matter: they always remove the ovaries on the least provocation.

Fig. 3.

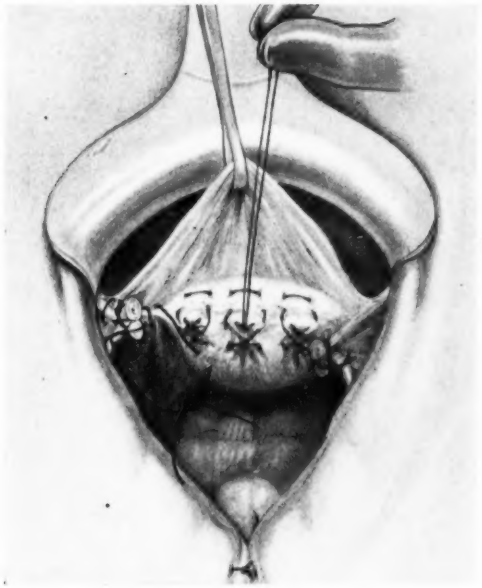

Fig. 4.

In general, I think it is better not to leave an ovary in the pelvis when there is any likelihood that there has been interference with the blood-supply; sometimes, however, it is possible safely to do so. I have dealt with this matter in a paper on ovarian grafting published in SURGERY, GYNECOLOGY AND OBSTETRICS (December, 1925, p. 706), and shall not, therefore, go into the problem here, beyond saying that in women under 40 years of age an ovarian graft should be made if both ovaries are removed from their normal connections.

TECHNIQUE OF THE BELL-BEUTTNER OPERATION

I must first make it clear that in my original publications (2, 3) the technique adopted was not so elegant and satisfactory as the almost immediate improvements have now made it (4, 5).

Further, although in the United States the operation has been called the Bell-Beuttner operation, it should be understood that in this designation the similarity of principle (6, 7) rather than that of technical detail is implied. Moreover, although I was unaware of the fact, and devised the operation quite independently, there is no doubt that Professor Beuttner's first communication (6) preceded mine.

The following are the chief points in the method I practice.

1. As in dealing with any case of salpingitis, it is important for the surgeon, after separating adhesions to omentum and bowel, if these be present, to free completely the adherent tubes and ovaries, and also the uterus if it be bound down in a position of retroversion (Fig. 1).

2. The infundibulopelvic and round ligaments are ligated together on both sides, if the ovaries are to be removed, and an additional ligature is tied round each infundibulopelvic ligament as a measure of safety (Fig. 2).

3. If one ovary can be retained in position, the mesosalpinx of the same side is divided as close to the affected tube as possible. Vessels are caught in forceps and ligated subsequently. A ligature placed around the ovarian and round ligaments includes the terminal anastomotic branches of the uterine artery on this side (Fig. 3).

Fig. 5.

4. After the ligation of vessels mentioned, according to the intention of the surgeon, to leave an ovary *in situ* or not, as described in the preceding paragraphs, a transverse flap of peritoneum of the uterovesical pouch is raised, and the uterine arteries on either side are ligated at a level about one-half or three-quarters of an inch above the internal os uteri (Fig. 2).

The entire blood supply of the parts concerned is thus arrested, and the operation should be almost bloodless.

5. The ovaries and tubes are cut free on either side—unless the tube on one side has already been detached leaving an ovary in position—up to the lateral aspects of the uterus above the ligatures placed on the uterine arteries.

6. A transverse wedge-shaped portion of the fundus is now excised by means of anterior and posterior incisions (Figs. 2, 3, and 4).

7. The V-shaped raw area left in the uterus, with the lower part of the uterine cavity showing in the angle, is closed by means of the mattress-and-over suture, which I employ so frequently in operations involving suture of the uterus and of the vaginal walls, and which is best effected with a Reverdin needle. The mattress stitches, when tied, bring into apposition the deeper parts of the uterine wound, and the "over stitches," made with the long ends of the threads left after the mattress stitches have been tied, close effectively the edges (Fig. 4).

8. The pedicles on either side, in which are contained the round and infundibulopelvic ligaments, or on one side the round ovarian ligaments, are fixed by means of a suture fairly high on the back of the utriculus (Fig. 4). By this means the small uterus is kept forward, an important consideration if there be raw surfaces in the pouch of Douglas, where adhesions have been separated.

9. The flap of peritoneum which was raised from the uterovesical pouch is now brought over the utriculus, and sutured to the posterior wall. In this way the line of suture at the summit of the small uterus is completely covered. In a like fashion with lateral sutures the attachments of the pedicles to the posterior surface of the uterus are covered smoothly with peritoneum (Fig. 5).

This last detail of technique is most important, for intestinal adhesions to the line of suture in the uterus would be most difficult to prevent if a covering of peritoneum were not used.

Figures 6 and 7 are photographs of specimens after removal. Figure 6 shows a double pyosalpinx with ovaries, and the wedge-shaped portion of the fundus excised. In this case an ovarian graft was made.

Figure 7 shows a left pyosalpinx and an occluded tube on the right side. In this case it was possible to retain the right ovary.

The mortality rate of 2.3 per cent may be regarded as very satisfactory, when it is remembered that the operation is only concerned with a serious type of infection, and that the cases include those of puerperal origin.

In Beuttner's clinic there were 5 deaths in the first 40 cases—a mortality rate of 12.5 per cent. As the deaths in the Geneva clinic were chiefly due to peritonitis, it appears that care could not have been taken to operate only when the condition was chronic.

It will be observed that functional results have been obtained in a large number of

Fig. 6.

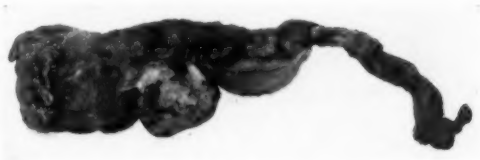

Fig. 7

CLINICAL RESULTS

A

	Number	Per cent
Cases in which the Bell-Beuttner operation was performed together with ovarian grafting	108	
No after-history obtainable	30	
Mortality	3	2.6
Operation too recently performed for result to be estimated	9	
Number of cases considered	66	
Menstruation occurred	45	68
Menopause was averted	51	77
Probable number in which absence of menstruation was due to failure of graft	15	22
Successes		88

B

	Number	Per cent
Cases in which the Bell-Beuttner operation was performed and an ovary retained *in situ*	19	
No after-history obtainable	9	
Mortality	0	0
Operation too recently performed for result to be estimated	1	
Number of cases considered	9	
Menstruation occurred	8	89
Menopause occurred, indicating ovarian insufficiency	1	11
Successes		100

C

TABLES A AND B SUMMARIZED

	Number	Per cent
Total number of cases	127	
No after-history obtainable	39	
Mortality	3	2.3
Operation too recently performed for result to be estimated	10	
Number of cases considered	75	
Successes		90

cases. Yet, whereas we should consider the absence of menopausal symptoms as a positive functional result in the presence of a retained or grafted ovary when menstruation is impossible because the uterus has been removed, in this particular procedure the whole object is to secure the persistence of menstruation, without which many women do not consider themselves normal, as I could illustrate with actual instances had I time to discuss the psychology of women on this matter. So it is necessary to classify the cases in order to show when the absence of menstruation has been due to failure to function of the grafted tissues. This has occurred in 22.7 per cent of all my cases of ovarian grafts.

In one instance the menopause supervened when an ovary had been retained.

It is obvious from the statistics that the percentage of successes is greater when an ovary is retained than when an ovarian graft is made.

CONCLUSIONS

1. The preservation of the genital functions in the female, even though conception be impossible, is a surgical ideal to which we should strive to attain, whenever operations on the female genitalia may be necessary.

2. It is possible by the procedures described, combined with ovarian retention or grafting, to obtain highly satisfactory results —that is, 90 per cent of successes—in a type of lesion which has usually been considered amenable only to eradicative measures. Somewhat better results are obtained if an ovary can be retained, but this is only possible in about 15 per cent of all cases in which the Bell-Beuttner operation is indicated.

I am much indebted to Dr. S. B. Herd for the trouble he has taken in compiling the statistics of the operations and after-histories of the patients.

REFERENCES

1. Bell, W. Blair. Lancet, 1913, ii, 597.
2. Idem. Burghard's System of Operative Surgery, 1914, v, 241.
3. Idem. Surg., Gynec. & Obst., 1914, xvi, 634.
4. Idem. Principles of Gynæcology. London: 1919.
5. Idem. J. Am. M. Ass., 1921, lxxvii, 696.
6. Beuttner, O. Die transversale fundale Keilexzision des Uterus. Stuttgart: 1911.
7. Ernst, R. Excision transversale cunéiform du fond de l'uterus par le procédé de Beuttner. Genève, 1918.
8. Holtz, F. Acta Gynec. Scand., 1925, iv, 1.

CHRONIC PELVIC INFECTIONS

Deductions Resultant from a Combined Clinical and Laboratory Study[1]

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NUMEROUS modern contrivances have added materially to the world's sum-total of comfort and happiness. Unfortunately, some of them have also introduced serious complications. The automobile, for example, has facilitated murder and banditry, has served to increase extravagance and wastefulness, and has become a death dealing weapon in the hands of the reckless.

The scalpel and scissors and the uterine curette have likewise sometimes brought sorrow rather than relief. Gynecologists remember with chagrin the former tendency to needless sacrifice of healthy ovaries. We have learned, also, from the school of experience, the folly of operation upon patients who suffer from acutely infected tubes. Soon, we hope, the curette will no longer be used to stir up postabortive infection. Eventually, women seriously ill with childbed fever may be permitted to recover spontaneously, spared the morbidity and mortality which inevitably accompany radical surgical intervention.

In the few minutes at my disposal I wish to picture the present status of our knowledge of certain pelvic infections; this may permit me to point out further modifications in the indications for gynecological surgery. Of necessity, the deductions presented may be somewhat at variance with generally accepted views; if seemingly unwarranted, I beg your indulgence.

CHRONIC LEUCORRHŒA

The subject of leucorrhœal discharges has long remained a mystery. Until comparatively recent times leucorrhœa was supposed to originate chiefly in the uterus. In fact, a tour of the leading gynecological clinics, a dozen years ago, revealed that curettage for relief of "chronic endometritis" was the most frequently performed surgical procedure.

Laboratory study and clinical investigation of patients with leucorrhœa have contributed considerable information. Although much of this subject still remains unsettled, we have learned that chronic discharges arise chiefly from the cervix and from glandular pockets in the vicinity of the urethra. It has also been found that approximately 30 per cent of all patients with chronic purulent leucorrhœa are carriers of virulent streptococci. This means that 1 out of every 3 patients with persistent purulent vaginal discharge is a candidate for spontaneous postpartum infection. (This is particularly true of those who develop, at labor, cervical lacerations which extend upward into the cellular tissues of the broad ligaments.) Likewise, operation by the vaginal route upon these leucorrhœal carriers of streptococci, is accompanied by more than the usual risk of postoperative pelvic peritonitis.

In contrast, I wish at this time to point out the fallacy of overemphasis of cervical infections as foci for arthritis and other serious systemic disturbances. It is true leucorrhœa may be cured by removal or destruction of the diseased cervix; also, a considerable number of patients may be thus relieved of sterility. But systemic infection from chronic cervicitis appears to be unusual and we must be guarded in forecasting a notable improvement in general health as the result of plastic surgery upon the diseased cervix.

THE ENDOMETRIUM

In 1918 there was reported a combined bacteriological and histological study of the endometrium. This investigation of the thoroughly ground endometrium from 118 uteri, obtained by hysterectomy, indicated that chronic infection of the lining of the uterus is unusual. Since 1918 approximately 15 per cent of all uteri removed have been subjected to similar study. These more recent results are confirmatory of previous evidence. It follows that supravaginal removal of the chronically diseased body of the uterus is

[1] Read at the Clinical Congress of the American College of Surgeons, Philadelphia, October 28, 1925.

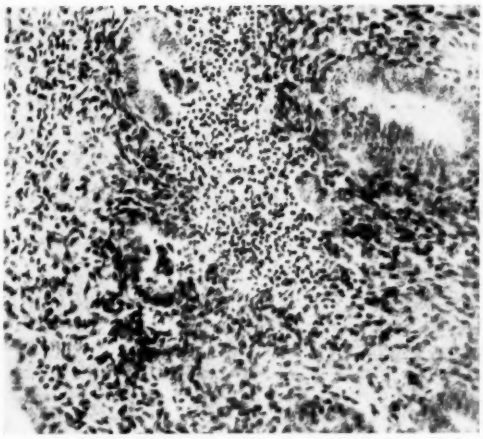

Fig. 1. Acute endometritis; a relatively frequent occurrence after diagnostic curettage. Hysterectomy should preferably be performed at the time of curettage or postponed until subsidence of the inflammatory reaction.

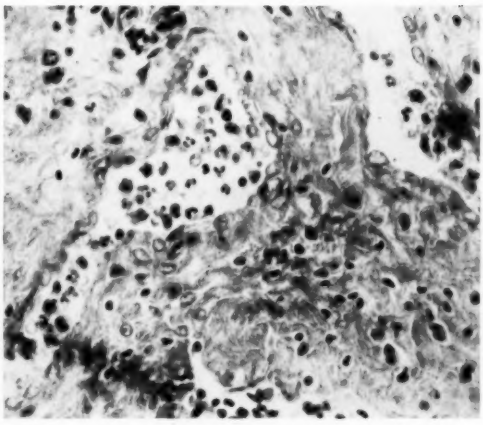

Fig. 2. Further evidence of infection after curettage. Endometrium from a uterus which had been curetted one week previous to hysterectomy.

a clean procedure; iodinization or cauterization of the uterine stump is ordinarily superfluous.

On the contrary, a lesser group of these cases deserves special mention. We have gradually accumulated uteri which had been curetted or packed several days previous to hysterectomy. Many of these reveal bacteria in cultures of the ground endometrium and histological evidence of infection. It would appear that extensive instrumentation of the uterine cavity introduces the possibility of temporary acute endometritis. Since recognition of this complication, we have followed the clinical course of all available patients known to have been subjected to removal of the fundus some days after the uterus had been packed or curetted. These individuals reveal a considerable incidence of postoperative peritoneal infection.

Furthermore, study of patients after criminal abortion yields corroborative evidence. The abortionist can enter the clean uterus almost with impunity. But if he fears the fetus has not been removed, and ventures to invade a second time, he stirs up bacteria introduced at the first instrumentation. High morbidity or mortality after abortion is almost pathognomonic of repeated invasion or instrumental perforation of the uterus.

THE FALLOPIAN TUBES

Study of the fallopian tubes revealed long ago that gonorrhœa attacks the tubes from within, whereas streptococcus infection of the tubes is but a part of more widespread streptococcic pelvic infection.

Gonorrhœal tubes. For some time it has been known that the gonococcus does not live long in the lumen of the tube. It has always been assumed that the bacteria remain viable in the deeper tubal wall and that chronic infection is thus maintained.

In a search for dormant infection, cultures made of over 200 thoroughly ground fallopian tubes revealed that it is almost never possible to obtain the gonococcus longer than 2 weeks after disappearance of fever and leucocytosis. Upon completion of the major portion of this work, in 1921, we came to the conclusion that gonorrhœal salpingitis is a self-limited process; persistently active gonorrhœa of the tubes appeared ascribable to *recurrence* of infection from without, rather than to chronic infection. Furthermore, it appeared, also, that male carriers are not the only source of tubal reinfections; gonococci remain long viable in the lower genital tract and fresh infection of the tubes may result from traumatism of the cervix or from the passage of vaginal douches upward through the cervical canal.

Fig. 3. Mother and son, a demonstration of the value of conservative treatment. This patient had acute salpingitis after marriage and was treated conservatively. Operation was performed 4 years later for relief of pelvic adhesions and sterility. Left hydrosalpinx was removed; the adherent occluded right tube was released, the fimbriæ opened, and air forced through the lumen of the tube into the uterine cavity. Pregnancy occurred within 5 months. A second baby is expected soon.

It had previously been our custom to remove notably diseased tubes of service patients after complete subsidence of acute infection. Now (in 1921) we began to avoid operation. Patients were isolated from their sources of infection, were forbidden to take douches, and were treated expectantly. As a result, it was found that those who suffer from only one attack of salpingitis rarely have severe symptoms or reveal extreme pathological changes. Even those who have been repeatedly infected tend to ultimate recovery if removed from consorts who are carriers of disease.

From bacteriological study combined with 5 years' conservative clinical experience we have concluded that operation upon fallopian tubes for eradication of gonorrhœal infection is not often indicated. The infection disappears spontaneously if the patient is isolated from the source of her disease. Expectant care eventuates in clinical recovery of the great majority of patients and is beneficial to those who must ultimately obtain operative relief. Surgery should usually be long delayed and reserved chiefly for sequelæ, such as adhesions, menstrual disturbances, and sterility.

To those who would ask whether operation is not always indicated in patients with a history of repeated attacks, I would suggest that the most satisfactory management is "conservatism"; such, for example, as a gynecologist of today might observe in the care of his sister before resorting to surgical intervention.

It may be thought that women can not be persuaded to abstain from exposure to repeated infection. This is seldom true. The difficulty lies in the fact that we have overestimated the persistence of a single infection and have not sufficiently emphasized the danger of subsequent exposure. When a sufferer from salpingitis is frankly informed that she must choose between prolonged abstinence and surgical removal of the genitalia, conservatism wins. (Occasional indulgence, later, with sheath protection, is a helpful compromise measure.)

Streptococcus infection. Streptococcus infection of the tubes, as previously stated, is but part of more widespread pelvic involvement. The complete picture may, however, closely resemble gonorrhœal disease. A history of abortion, a persistent tendency to aching distress in the pelvis, a prolonged tendency to slight chills or low grade fever, are suggestive.

The tissues may yield bacteria for a long period of time: 6 months is fairly common; recovery of streptococci after 2 years is not infrequent; in one instance they were obtained 18 years after the initial infection.

Here, too, it seems best to operate only for complications or sequelæ. When relief of symptoms demands intervention, 6 months is surely the minimum length of time to allow for subsidence of infection. If possible, operation should be postponed for 2 years or more.

When surgery is undertaken, we believe that a more radical attitude toward removal of infected ovaries is indicated in streptococcic cases because there is considerable danger of recurrent infection. Drainage is occasionally

expedient, even in the absence of pus, and despite the fact that the use of drains in pelvic surgery is nowadays less in vogue.

CONCLUSIONS

1. Operation by the vaginal route, upon patients with chronic purulent leucorrhœa, introduces an increased risk of postoperative streptococcic pelvic peritonitis.

2. The endometrium of the body of the uterus is nearly always free from bacteria. Supravaginal hysterectomy is, therefore, ordinarily a clean procedure.

3. Mild infection of the endometrium is relatively frequent after diagnostic curettage. Hysterectomy should preferably be performed at the time of curettage or postponed until subsidence of the inflammatory reaction.

4. Operation upon fallopian tubes for eradication of gonorrhœal infection is not often indicated because the infection tends to disappear if patients are isolated from consorts who are carriers of disease. Surgery should usually be long delayed and reserved chiefly for sequelæ, such as adhesions, menstrual disturbances, and sterility.

HEPATIC FUNCTION IN HEALTH AND DISEASE[1]

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SMALL organs have often engaged the attention of great men, but at the present time the liver, the largest organ in the body, is exciting the interest of many profound students.

HEPATIC FUNCTION IN HEALTH

Metabolism in sugar. The liver is not only the fuel storehouse of carbon in the form of sugar or glycogen from which store the blood sugar level is maintained, but it is also the site where glucose is made from other materials. Although nearly an equal amount of glycogen is stored in the muscular tissue, this probably has little to do with maintaining the blood sugar level, but is for the immediate use of the muscle cells. Muscular activity is associated with partial combustion of glycogen to form lactic acid. Part of the latter is completely consumed, and part is reconverted into glycogen between muscular contractions. During violent overstrain, lactic acid is not quickly enough disposed of; its accumulation leads to the sensation of fatigue, since rest is necessary to clear the field for further action. The thyroid gland, with the best arterial circulation of any structure in the body, makes the energy of cells available for use, as pointed out by Plummer. It may be said that its function is one which deals with oxidation. The arterial supply of the liver, an organ weighing between 1,700 and 1,800 grams, is comparatively small, while the venous blood from all the viscera in the abdomen is brought to it through the portal circulation carrying the products of digestion to be transformed and stored, and the fluids from the colon, especially its right, have to be redistilled by its functional activity. Probably the most important of these products, as regards the action of the liver, is glucose. Its excess of carbon is in harmony with its purpose, as sugar consists of three elements, carbon twelve parts and the equivalent in hydrogen and oxygen of eleven molecules of water.

The exact functions of the liver have been most difficult to study, and while many new facts concerning them have been recently developed, there are still many of its functions awaiting elucidation. The first experimental investigations were made by ligation of its blood vessels and later by total abdominal evisceration in an effort to study as rapidly as possible, while life lasted in the many types of animals used, the changes in the blood as they occur before death from the loss of function or loss of the organ. The life of such animals under the methods described for eliminating hepatic function have been very short, from a few minutes to only an hour or

[1] Read before the Clinical Congress of the American College of Surgeons, Philadelphia, October 26, 1925.

two at best. It is impossible to remove all of the liver without including a segment of the vena cava. However, if a portion of the liver is left in the body without blood supply, the tissue is rapidly destroyed by autolysis which in turn causes a toxic condition differing very materially from the loss of liver tissue alone. This has impaired the accuracy of the results obtained by investigation in cases in which a portion of the liver is left *in situ* without blood supply. On the other hand, most of the normal liver can be removed, a functioning portion with intact blood supply being left, and the remaining portion will be quickly restored by hypertrophy and hyperplasia. After at least 70 per cent of a dog's liver has been thus removed without producing a noticeable effect on the animal, the approximate normal amount of liver tissue will be restored in 8 weeks. Mann developed a method of total removal of the liver in the dog which overcame the difficulties mentioned. He removed the organ in three stages. First, after a reverse Eck fistula had united the portal vein and vena cava, the latter was ligated proximal to the stoma. Later, when a collateral circulation was established, the portal vein was ligated. This ultimately permitted the total removal of the liver with but little impairment of return of venous blood to the heart from the lower limbs and abdominal viscera. Mann and his coworkers, Magath and Bollman, found that when the liver is totally removed, the blood sugar level is greatly lowered, until at a definite point an animal which, having shown little apparent disturbance physically from the loss of the liver, suddenly develops muscular weakness and in a short time becomes moribund. However, the injection of glucose, 0.25 to 0.50 grams to each kilogram of body weight of the animal, restores it immediately to normal. Without this, death would have followed in a few minutes. If the blood sugar is maintained at approximately normal level by administration of glucose, the animal may be sustained in a comparatively active physical condition for many hours; the longest time has been 35 hours. Death is eventually caused by other conditions than loss of sugar.

Metabolism of bilirubin. Bilirubin has long been regarded, to a large extent, as produced in the liver, and a portion in all probability is of hepatic origin. However, it is also made outside the liver from hæmoglobin in the reticulo-endothelial areas of the body. The bilirubin content of arterial blood in all parts of the body is the same. Venous blood returning from the spleen or from bone marrow, areas which contain reticulo-endothelial cells, shows a definite increase in its bilirubin content, while the bile pigment content of venous blood returning from the kidney, muscle, or from an extremity after removal of the bones only, remains the same as that of arterial blood. When the liver is totally removed from a dog the animal becomes jaundiced, because of the loss of the means of excreting the bile pigment that is produced in the spleen and bone marrow.

Metabolism of urea. Many nitrogenous compounds are very unstable; when confined in condensed masses chemically the nitrogenous molecule becomes the explosive energy of warfare. In the body the protein matter taken as food is split in the intestines into many varieties of amino-acids. The amino-acids are all taken into the blood, and those which cannot be employed to restore tissue are changed by the liver into glucose and urea. About 60 per cent of the energy-containing carbon portion of the protein is thus saved to the body as glucose, while the nitrogen which the organism does not utilize is converted into urea and eliminated by the kidneys. When the liver is totally removed, urea is not formed and uric acid is not destroyed, proving that the liver is necessary for these important phases of nitrogen metabolism. The liver then not only furnishes the coal bunker but prepares the ashes of destruction in a form for removal. If the liver is removed during the hyperglycæmia following extirpation of the pancreas, the blood sugar becomes lowered more rapidly, but the conditions otherwise are the same.

Function of the gall bladder. There has been, for a long time, much discussion about the absence of the gall bladder in some animals. Its presence or absence does not seem to follow any definite rule, and is never a familiar characteristic. With few exceptions, however, the leaf eaters have no gall bladders; this

group also includes those animals that cast their horns and antlers yearly. Leaves as a food have a higher calcium and potassium content than grasses. The pocket gopher, passing his life beneath the surface of the ground, has no gall bladder, while the striped gopher living beneath the soil but feeding above it has one. The rat has no gall bladder, but the liver makes bile eight times stronger than the bile of the mouse which has a gall bladder.

The liver, as well as the pancreas, arises from a common diverticulum of the foregut. This elongates to form the common duct together with a solid outgrowth which becoming hollow later attaches to the hepatic substance to form the gall bladder. The great mass of liver tissue checks blood pressure to a low point within it, while the gall bladder with its cystic artery has the full arterial pressure. Mucus cannot be as readily absorbed as bile. The mucous membrane of the gall bladder continues to form mucus after obstruction of the common duct. At first the gall-bladder contents are saturated with bile salts which later become reabsorbed and the gall bladder and all ducts remain filled with mucus or so-called white bile. The gall bladder contains approximately an ounce of bile under normal conditions. The cystic duct is one-eighth of an inch in diameter, being tortuous like the letter S, and unites with the common duct, which approximates one-sixth of an inch in diameter. Sweet has described minute saccules distributed along the hepatic duct which could possibly to some extent absorb bile fluids. The gall bladder has no suction power, and can fill from the common duct only by contraction of the terminal sphincter muscle of the common duct at its opening into the duodenum, which has been given the name of its discoverer, the sphincter of Oddi. Meltzer worked out the law of contrary innervation as applied to the gall bladder and sphincter of the common duct. He suggested that magnesium sulphate would relax the sphincter. Lyons, employing a Rehfuss tube passed from the stomach into the duodenum, which makes it possible to deliver fluids into the duodenum uncontaminated by gastric juice, made use of this suggestion of Meltzer to develop his so-called physiologic drainage of the gall bladder. Peptone is also thought to relax the sphincter. Intraduodenal lavage with such solutions is supposed to cause the sphincter of Oddi to relax. The first bile that appears is darker than the bile of the hepatic duct and lighter than the bile from the gall bladder; this is followed by the dark gall-bladder bile and later by the light bile flowing from the hepatic ducts into the duodenum from which it is sucked by the Rehfuss tube. On the other hand, Sweet and Halpert contend that little or no bile which enters the gall bladder through the cystic duct leaves by that route. The pressure withstood by the sphincter of Oddi in the animals without a gall bladder is very low, being but a few millimeters of water. In such species, the bile passes into the duodenum without obstruction. In those animals which have a gall bladder the pressure is not necessarily the same in the gall bladder as it is in the common duct, and varies from 50 to 150 millimeters of water. The gall bladder in contracting during filtration closes its outlet. As a result of the association of activity of gall bladder and sphincter, removal of the gall bladder is followed by relaxation of the sphincter of Oddi to the level of that in animals without a gall bladder, as a rule. At the angle at which the pancreatic duct unites with the common duct, the sphincter of Oddi usually cannot accomplish its closure without interfering with the pancreatic duct. Fortunately, the pancreas has two ducts, usually connected. The pain in the back accompanying gall-stone colic is probably due to pancreatic colic. In the gall bladder of man, bile is ten to eleven times as concentrated as the bile in the hepatic ducts. In diseases characterized by dark bile and salts and stones it is much more concentrated than this.

Ligation of the common duct in animals with a gall bladder distends the gall bladder and probably increases its function of filtration of fluids. In dogs, sufficient bile pigment appears in the blood in from 24 to 36 hours to give a positive van den Bergh test. Clinical jaundice does not appear for from 72 to 120 hours. However, if the gall bladder is removed or the cystic duct ligated at the same time the common duct is ligated, bile pigment appears

in the blood in amounts sufficient to give a positive van den Bergh test in from three to six hours and jaundice in twenty-four hours. For some reason, then, in certain types of life there is a need for concentrating bile, or for bile fluids to reach the blood stream through the lymphatics without coming in contact with the alimentary canal. In some animals, without a gall bladder, the presence of its physiologic equivalent has been demonstrated. In the case of man this may possibly have been more important ages ago than now, although only a few cases are on record in which there is congenital absence of the gall bladder in man.

HEPATIC FUNCTION IN DISEASE

Formation of gall stones. Gall stones are of varying color and density; single cholesterin stones, crystalline and amorphous, are found in gall bladders with little change from the normal. Less concentrated cholesterin with varying quantities of bilirubin of calcium and bile salts form the great mass of gall stones. Among the thousands of patients operated on, one practically never finds a stone in the process of formation, although recent stones may be soft and others of varying degrees of hardness in the same gall bladder. A stone may increase by secretion of bile salts retained in a gall bladder compelled to filter an excess of bile fluids at a higher constant level of pressure produced by a contraction or spasm of the sphincter of Oddi. The trigger action of excess of fatty bodies in the blood and toxins of infection may suddenly and as quickly start and complete the formation of a stone, or the addition of another layer to a stone as a hen can cover an egg with carbonate of calcium, that is, in one day. The conception of disease of the gall bladder from overwork is being recognized as the basis of the development of gall stones. The excess of cholesterin in the blood is eliminated by the liver. Cholesterin forms one-fourth of the blood fat and it is increased in pregnancy. Cholecystectomy is now performed unless it is contra-indicated by special complicating conditions. The gall bladder is darker if the liver is diseased; its edges are rounded and not sharp and rapidly spreading like the normal axe-like edge. It is mottled, and the fine lobulations on its surface are readily seen. The area of lymphatic filtration around the gall-bladder attachment extending for 2.5 or 5 centimeters may show in many cases extensive connective tissue giving a local cirrhotic appearance, but of lighter color. The glands on the cystic, common, and hepatic ducts are enlarged in proportion to the hyperfunction thrown on them through excess drainage. Back of the trouble is the suggestion that stimulation of the sympathetic nervous system may account for spasm of the sphincter of Oddi which undoubtedly precedes and accompanies not only hepatic changes but diseases of the gall bladder itself and its secondary gall stones. The stimulation of the sympathetic system may be the result of changes in the hepatic function, dependent, in turn, on injudicious eating and the strain of modern ways of living. The amount of sugar eaten by the individual has increased a pound a year for 100 years, and now amounts to approximately 112 pounds.

An excess of sugar fuel above what can be immediately used or stored as glycogen is converted into fat and deposited in and over the body as such, and like a blubber that insulates arctic animals is a hydrocarbon which is mostly again reconverted into sugar for burning, in case of need.

We all have a most wonderful sugar machine of our own for reducing carbohydrate food to glycogen. Is it possible that we are stoking our human furnaces too heavily and burning out our boiler flues (the overworked kidneys), and that the retention of the ashes destroys our fire boxes and grates?

Nowadays we live in flats and kitchenette apartments and eat canned foods. Scientific progress permits us to enjoy preserved foods from every corner of the world, but it is possible that man has physically failed to keep pace with such progress. These canned foods contain insufficient amounts of vitamins, and in cold-storage food the vitamin is in varying degrees of decay. It is possible that we are paying too heavy a price for our conveniences and luxuries; at any rate these are points for investigation in the near future.

In 1910, Rowntree studied phenolsulphonephthalein as a test of renal function. During

his experiments he found that the chlorphthaleins were eliminated by the liver and thrown into the alimentary tract with the bile. Tests of the stool gave but an approximate valuation of hepatic function. Rosenthal made this more accurate by the test of injecting dye material into the blood and determining the rapidity with which it was removed from the blood by the liver.

Graham and his coworker, Cole, found that the bromine and iodine substitution products of phenolphthalein were eliminated by the liver and when thrown into the bile entered the gall bladder in a normal manner and made its size and shape visible by fluoroscope or roentgenogram. When it was in a diseased condition or contained stones, very little or none at all of the dye entered the gall bladder. This lack of visibility of the gall bladder made diagnosis of disease of it probable. The reaction of the injection has been overcome in the clinic by giving the phenoltetrabromphthalein in a capsule by mouth containing 0.1 gram of the dye for each kilogram of body weight. It is of assistance in those cases which puzzle the diagnostician. Mann showed that the liver has an affinity for the chlorines to the degree that the injection into the blood stream of from 5 to 10 cubic centimeters of the Carrel-Dakin solution for each kilogram of body weight acts on the gall bladder and does not injure any other tissue unless a sufficient amount is used to destroy the animal; repeated injections will seriously injure the viscus.

The bilirubin of the serum is now determined quantitatively and specifically by means of the van den Bergh test. Whereas the content of normal serum never exceeds 2 milligrams for each 100 cubic centimeters, values up to 20 or 30 milligrams for each 100 cubic centimers may be encountered in jaundice. The nature of the reaction also indicates in many instances whether jaundice is obstructive or hæmolytic in origin.

RELATION TO SURGERY

Status of the gall bladder. Years ago cholecystic disease was mainly considered to be gall-stone disease and the operation consisted of cholecystostomy, removal of the gall stones and drainage, every effort being made to conserve the gall bladder. There was no knowledge of the formation of the gall stone or the conditions leading thereto. Later advances led to exploration in many cases in which there were symptoms of gall stones; if no stones were felt, the gall bladder was not opened, but if symptoms and more severe spells continued, within a few years a second operation would be performed and the gall bladder would not infrequently contain many stones. Cholecystitis or inflammatory disease was discussed and cholecystostomy performed on the gall bladder with adhesions, change in color, and thickened wall. Not only was the disease unaffected, but in many cases adhesions arose after operation which attached the gall-bladder wall to the abdominal wall, leading to more trouble than before operation, and cholecystectomy entered the field of surgery for the diseased gall bladder, whether stones were present or not. At this time a sufficient interval had elapsed since the original removal of gall stones for many patients to have had recurrence of symptoms, and operation for the removal of newly developed gall stones a second or even a third time within a few years. It was concluded that the gall bladder was probably not so important a structure as it was at first believed, and like a diseased tonsil a diseased gall bladder could be removed with benefit to health.

Operative risks. Bile in the blood, from obstruction of the common duct, greatly delays its coagulation time. Hæmorrhage is one of the serious risks of operation during conditions of jaundice. While many have made a study of this problem, in the clinic it has been carried on by Hallenbeck and Giffin and finally standardized by Walters who prepares such patients by injecting intravenously 5 cubic centimeters of a 10 per cent solution of calcium chloride once daily for 3 days preceding operation; in hundreds of cases we have had no untoward accident or local destruction of tissue from these injections such as have been described. This method brings the coagulation time, which has been from 12 to 20 minutes, down to from 6 to 9 minutes and greatly lowers the risk from hæmorrhage. The improvement is maintained if, in the operation, the surgeon is able to provide drainage of

bile internally and externally, and thus relieve the tension in the liver regardless of the cause of obstruction. Many persons chronically sick, who have taken but little food for weeks, have difficulty in maintaining their blood sugar level. Therefore, sugars are given by mouth, and glucose by bowel, if required before or after serious operations.

The most common cause of death following surgical operations is disease of the lungs, the next renal complications, and the third cardiac complications, although the latter condition is most feared by those who are ill.

Embarrassment of hepatic function. When the liver is under continued stress from congestion and the higher pressure from spasm of the sphincter of Oddi, it continues to form bile. On account of the low blood pressure in the liver tissue, the back pressure is not so serious nor so rapid in its results as chronic obstruction of the urinary bladder by a hypertrophied prostate; and the sudden relief of tension caused by draining the hepatic duct in cases of jaundice with white bile is seldom associated with the same risk as attends the sudden emptying of the greatly distended urinary bladder in old men, although a sudden cessation of hepatic function sometimes follows, comparable to the cessation of renal function. Greatly distended gall bladders require mechanical devices to provide for slow emptying.

In certain cases, when the liver is not functioning adequately, it may be relieved or assisted. Administering bile frees the gall bladder under tension during fasting. Its flow is increased by ox gall and nitrogenous food, but not by calomel. Rich carbohydrate food checks it. In the chronic deficiency of the liver associated with cirrhosis and splenic enlargement, the removal of the greatly enlarged spleen reduces by 20 per cent the work of the liver and relieves and conserves the organ. In the probable deficiency consequent to chronic general disease with emaciation, the physician must think of the lack of liver glycogen to maintain blood sugar, and nourish the patient accordingly. If any kind of operation is required for such patients the surgeon must be prepared to restore blood sugar by the intravenous injection of glucose, and also to maintain a normal or higher temperature during and after operation. By such conservative methods the old death rate of from 10 to 15 per cent attending operations in the presence of jaundice has now been lowered to 3.5 per cent.

Ascites may not be entirely the result of hepatic deficiency, but may depend on some obscure systemic defect. Treatment by novasurol has shown more satisfactory and more permanent restoration of hepatic function than the mechanical withdrawl of the fluid. The embarrassment of the liver in cirrhosis with ascites is not to be explained entirely by the vicious circle of endogenous and exogenous pressure.

CARCINOMA OF THE MALE BREAST[1]

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THE etiology of carcinoma of the male breast is undoubtedly the same as of carcinoma elsewhere. Differences in function probably account for its comparative rarity in the male.

The male and female breasts are embryologically of the same origin and develop alike until puberty. At this period the female breast undergoes a marked change, coincident to the development of sex characteristics. New ducts, glandular elements, and so forth, are formed. Pregnancy produces another characteristic change, namely an hypertrophy and hyperplasia of the glandular structure which is followed by regressive changes at the cessation of lactation. Finally, after the menopause, the glandular elements atrophy. This marked difference in function with rapid proliferation and regression during pregnancy (which may be often repeated) and the regressive changes following the menopause explain, to a certain extent, the more frequent occurrence of carcinoma in the female breast.

Carcinoma of the male breast was first recognized and described by Thomas Bartholinus (1616–1680). Our present knowledge of this condition is based on the Poirier *Thesis* (1883) and the analysis of 100 cases by Williams in 1889 and 472 cases by Schuchardt in 1890. Williams in a series of 2,422 neoplasms of the breast found 2,397 in women and 25 in men, and of the latter only 16 were carcinoma. According to Schuchardt, the percentage of occurrence in men, as reported from various sources, is from 1.8 to 8.4 per cent. Later, Warfield in 307 cases of carcinoma of the breast found three in males. In the present series 1,751 were in females and 17 in males.

The relative occurrence in the two breasts has been variously reported. Fitzwilliams sums it up and says in 296 recorded cases of carcinoma of the male breast, 143 were on the left side and 148 on the right, while in 5 the condition was bilateral. In our own series, the left breast was affected in 10 cases and the right in 7.

It is generally accepted that the disease occurs a few years later in males than in females, although Blodgett reported finding it in a boy aged 12 years and Bryan observed it in one at the age of 14 years and 8 months. In Lunn's report the oldest patient was 91 years. In our cases, the oldest was 72 years and the youngest 38 years, the average age being 52.6 years. Eight of the 17 male patients were in the fifth decade.

There was a history of injury to the breast in only one case, and in only 4 was there a family history of cancer.

The known duration of the tumor before operation is variously stated as from 1 to 3 years. However, a search of the literature reveals a report by Owens and Eisendrath with the history of a patient who had a tumor of the breast for 35 years, while Moore records the case of one who had a tumor for only 2 weeks. One of our patients gave a history of a tumor for 18 years, although increase in size had occurred for only 2 years preceding operation; the shortest history was 4 months, with the average duration 31.2 months.

The pain, bloody discharge from, and retraction of, the nipple, and ulceration vary with the type, situation, and extent of the carcinoma, the variations being similar to those of carcinoma found elsewhere in the body. That ulceration in the male breast is more common than among females is readily understood, when one considers the normal relative difference in the distance from the overlying skin in the two sexes. Differences in the amount of retraction of the nipple are shown in Figures 1 and 2. Figure 3 shows a still more advanced type and illustrates ulcer-

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TABLE I.—CARCINOMA OF MALE BREAST

Case*	Age	Family history of carcinoma	Duration, years	History of injury	Breast involved	Glandular involvement	Extension to to pectorals	Grade	Remarks
1	44		1		Left	4		4	Died 1 year after operation, multiple metastatic lesions present.
2	72	Mother died, carcinoma of breast	1		Left	4	+	4	Died 1 month after operation, erysipelas. No malignant disease remained at necropsy.
3	62		1 1/6	+	Right	+		4	Patient not located.
4	56		1/12		Left	+		3	Died 6 years after operation. Necropsy showed carcinomatosis.
5	45	Father died, carcinoma of liver	2		Right			4	Letter 6 years after operation: patient in excellent health, able to pitch hay and do other forms of labor.
6	69		1		Right			3	Dead; date and cause not known.
7	42		3		Right	4	+	3	Simple amputation elsewhere 15 months before. Letter 16 months after operation here, no recurrence.
8	49		18		Right	+		3	Simple amputation elsewhere 18 months before. Returned 1 year after operation here with multiple recurrences; died 6 months later.
9	54		2		Left	4		3	Dead; date and cause not known.
10	49		1½		Left	4		3	Eleven months after operation roentgenogram showed multiple metastatic lesions in spine and lungs; patient died 2 years after operation.
11	57	Mother died, carcinoma	⅓		Right	+		4	Home doctor reported death from multiple metastatic lesions, 7 months after operation.
12	46		2		Left	4		2	Simple amputation performed elsewhere 2 years before. Died 10 months after operation here with multiple metastatic lesions.
13	48	Father died, carcinoma of stomach	6		Left	4		4	Six months after operation roentgenogram showed multiple metastatic lesions of right pelvic bones and femur; died within a year.
14	48		2		Left	4		4	Good results six months after operation.
15	38		2		Left	4		2	Unable to locate.
16	55		⅔		Left				Died following nephrectomy for hypernephroma 6 years after operation for carcinoma of breast.
17	60		2		Right			4	Letter 3 years after operation: no evidence of metastatic lesions.

*Roentgenograms of the chest were negative in each case.

ation, also metastatic nodules. Protrusion of the nipple is shown in Figures 4 and 5. In Figure 6 the original site of the neoplasm was probably as remote from the nipple as possible and the nipple involved by extension. Involvement of the nipple is the rule not because of its inherent susceptibility to carcinoma but because of the small amount of glandular tissue underlying it.

A radical operation was performed on each of our 17 patients. One death occurred, making an operative mortality of 5.8 per cent. Eleven of the 17 patients had one or more roentgenological treatments postoperatively. Eight of the 11 are dead and we were able to obtain information as to the postoperative length of life in all but 1, the average duration being 22 months. Three patients are known to be alive, 1 for 3 years, 1 for 16 months and 1 for 6 months. Six of the patients did not receive postoperative treatment with the roentgen-ray, and of those, 3 are dead, 1 after 4 years, 1 within a month, and 1 was reported dead but the length of life not stated. One is alive 6 years after operation, and 2 have not been located.

In 14 of the 17 patients we performed the primary operation, in 3 the radical procedure was for recurrence 15, 18, and 24 months after simple amputation done elsewhere. One of the 3 patients had no evidence of a recurrence 18 months after the secondary operation, 1 died 18 months, and 1, 10 months after operation. Two of the 17 patients have never

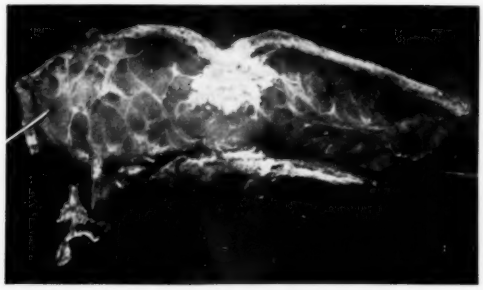

Fig. 1. Small neoplasm immediately beneath and involving the nipple, producing retraction of it.

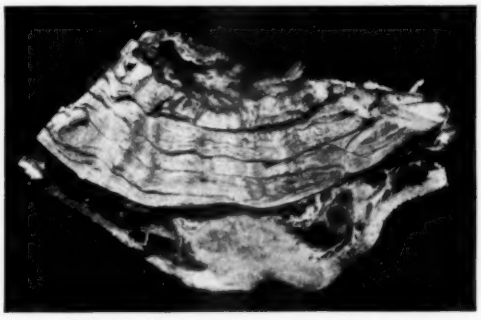

Fig. 2. More advanced stage of retraction of nipple than in Figure 1.

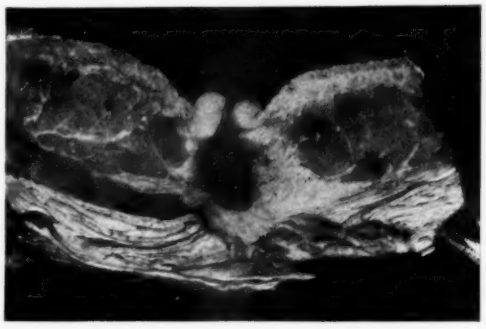

Fig. 3. Still more advanced stage of retraction than shown in Figures 1 and 2, with ulceration and metastasis.

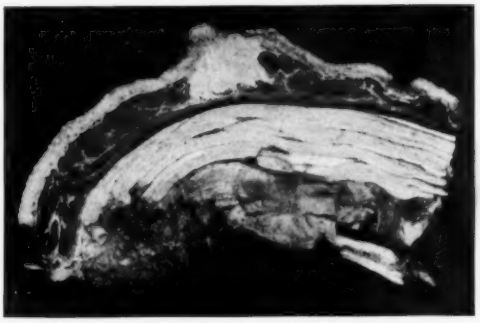

Fig. 4. Small neoplasm immediately beneath and involving the nipple, producing protrusion of it.

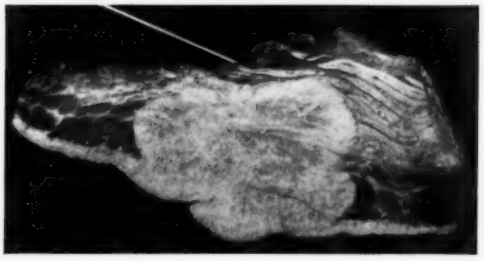

Fig. 5. More advanced stage of protrusion than in Figure 4.

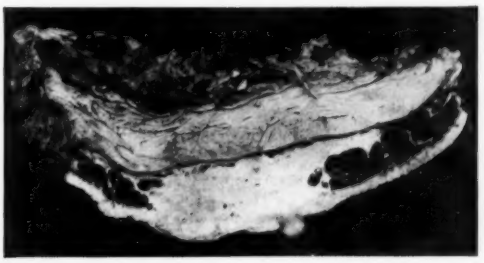

Fig. 6. Involvement of the nipple by direct extension from a distant neoplasm.

been heard from. Two were reported dead but the date and cause of death were not given. One patient died after operation from erysipelas. Seven died from metastasic lesions demonstrated in necropsies performed here or reported by physicians elsewhere. The greatest postoperative duration of life was 6 years and the least 7 months, the average being 19.5 months. One patient died following nephrectomy for hypernephroma 4 years after the radical amputation of the breast for carcinoma, and at necropsy no evidence of metastasis from the original tumor was found. Four patients are alive and show no evidence of any recurrence 6 months, 16 months, 3 years, and 6 years after operation.

Thirteen of the 17 patients had varying degrees of glandular involvement. Of the remaining 4, 1 has lived for 6 years and 1 for 3 years since the operation, 1 has not been traced, and 1 was reported dead but no information was given as to the date or cause of death.

These cases, as a group, showed a very high grade of malignancy when classified according to the method of Broders: 8 were graded 4, 6 were graded 3, 2 were graded 2, and in 1 case the tissue had not been preserved. That a high grade of malignancy is the rule in cases of carcinomata of the male breast cannot be definitely asserted as our observations are based on a small group, but nevertheless it would seem to explain the uniformly poor ultimate results obtained even with the most radical operative procedures.

CONCLUSIONS

1. It is probable that carcinoma of the male breast in most instances is a highly malignant type of neoplasm.

2. The results of radical operation for cancer of the breast are not as satisfactory in males as in females, very likely because in the former the tumors are generally of a higher degree of malignancy.

3. Tumors in the male breast should receive immediate radical operative treatment.

4. Good results are obtainable only by radical operation before glandular or other metastatic lesions occur.

5. Roentgenological treatment postoperatively does not seem to have arrested the progress of the disease to any appreciable extent in this series of cases.

BIBLIOGRAPHY

1. Bartholinus, T. Quoted by Warfield, p. 305.
2. Blodgett, A. N. Cancer of the breast in a child. Boston M. & S. J., 1897, cxxxvi, 611.
3. Broders, A. C. Personal communication.
4. Bryan, R. C. Cancer of the breast in a boy fifteen years old. Surg., Gynec. & Obst., 1914, xviii, 545–546.
5. Fitzwilliams, D. C. L. On the Breast. St. Louis: C. V. Mosby Company, 440 pp.
6. Lunn, J. R. A case of cancer of the breast in a man aged ninety-one. Tr. Path. Soc. London, 1896–1897, xlviii, 247.
7. Moore. Quoted by Warfield, p. 306.
8. Owens, J. E., and Eisendrath, D. N. Quoted by Warfield, p. 306.
9. Poirier, P. Quoted by Warfield, p. 305.
10. Schuchardt, B. Weitere Mitteilungen zur Casuistik und Statistik der Neubildungen in der maennlichen Brust. Arch. f. klin. Chir., 1891, xli, 64–100.
11. Warfield, L. M. Carcinoma of the male breast. Bull. Johns Hopkins Hosp., 1901, xii, 305–310.
12. Williams, W. R. Cancer of the male breast, based on the records of one hundred cases; with remarks. Lancet, 1889, ii, 261–263; 310–312.

TUMORS OF THE URACHUS[1]

With Report of Seven Cases

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BENIGN pathological conditions in the urachus are not uncommon and a great deal has been written of them. There is much less in the literature on malignancy of this structure, probably because this condition appears less frequently than the benign and probably also because malignant growths have been frequently overlooked. It is extremely difficult in some cases to draw a fine line of distinction between tumors of the umbilicus and those of the upper portion of the urachal tube. However, it must be remembered that a large percentage of pathological conditions of the urachus occur in its lower half.

In early fetal life the urachus develops from the allantois and until about the second or third month normally remains patent. At that time, it becomes obliterated and forms a cordlike structure running from the apex of the bladder to the umbilicus and serves as a median suspensory ligament of the bladder. The canal does not become obliterated simultaneously throughout its length, but at irregular intervals, so that small areas remain in which the lumen still persists. These may disappear later, or they may persist in the form of spindle-shaped cavities which probably give rise to many of the urachal cysts which we see clinically. The lining of this urachal tube is composed of one or more layers of transitional epithelium, very much like the mucous membrane of the bladder. There is a circular and a longitudinal coat of non-striped muscle about the canal, which in turn is surrounded by connective tissue (Fig. 1).

It seems fairly well established that many persons go through life without symptoms, with urachi which we do not consider normal. Uritz (2) examined 74 bodies for cysts of the urachus and in this number he found 24 undoubted instances. Morse (7) in 21 consecutive postmortems found 13 cases in which either a cyst or a patent urachus existed. In none of these cases had there been any antemortem indication of these pathological conditions. Of these 13 cases, 5 were females and 8 were males. This sex relation is near that given by Cullen (1), who found that in congenitally patent urachi, of 53 recorded, 35 were in males and 18 in females. However, Weiser (12) found in 89 cases that the sex ratio was 3 females to 1 male. The average age in the cases examined by Morse was 43.7 years. Gibb (4) says that cysts occur more commonly in females, while the patent urachus is more commonly found in males. He believes that this is true because of the greater occurrence of urethral strictures in men and also because of prostatic conditions which may cause urinary obstruction.

Patent urachus (Fig. 2). As we have said, many persons with patent urachi go through life ignorant of the condition which is present. If by any chance there should develop some obstruction to the normal urinary outlet with sufficient back pressure, a patent urachus might be brought to light for the first time. Just such an instance was recorded by Gibb (4). In a male 74 years of age, for 3 years there had been a gradual decrease in the amount of urine passed through the urethra. There was then an increased flow of urine at the umbilicus and one month before treatment was instituted all the urine was draining from an umbilical sinus. It was found that he had an enlarged prostate which was causing obstruction. A suprapubic prostatectomy was done, followed by bladder drainage for 12 days, with complete recovery.

A patent urachus may be closed in any part of its extent. It may be open at either end or both. The openings may be large or small; usually the bladder opening is the larger and often it is so large that the sacculated lower

[1]The material for this paper is from the Division of Surgery, Mayo Clinic.

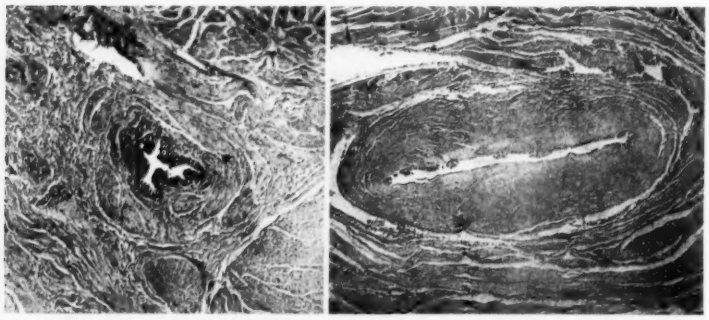

Fig. 1 (left). Showing a urachus near the bladder attachment. (X 60.)
Fig. 2. Showing a patent urachus at its bladder attachment. (X 30.)

end of the urachus forms a receptacle as large as the bladder itself. The urinary drainage at the umbilical end of the canal may be a few drops in a day, or it may be a large stream of urine, especially when the patient is voiding. In Paget's (8) case, reported in 1850, the patient voided urine through the umbilicus whenever he lifted a heavy object or micturated. Any act which increases the intravesical tension, increases the possibility of drainage from the umbilicus when a patient urachus exists. This actually occurred in Case 1. When the patient stretched, urine and a purulent material would discharge from the umbilicus.

Case 1. Miss E. S., aged 26, came complaining of kidney and bladder trouble. Every 3 to 4 days for 9 years, the patient had had pain between the symphysis and the umbilicus, associated with a purulent and occasionally a bloody discharge from the umbilicus. At times there was urinary discharge with radiating pain downward into the bladder region. This pain and discharge almost invariably would follow the act of stretching. There was marked increase in frequency of micturition, burning after voiding and occasionally there was blood, pus, and stringy material in the urine. The physical examination was essentially negative save for slight induration and tenderness in the midline between the symphysis and umbilicus. A 24-hour specimen of urine showed a slight amount of albumin and a few pus cells. The blood count showed a normal red cell determination, white blood cells 7,800, hæmoglobin 69 per cent, and the Wassermann was negative. Roentgen-ray plates of the kidneys, ureters, and bladder were negative. Cystoscopic examination showed a real cystitis III on the basis of IV. A diagnosis was made of a patent urachus and operation advised. At operation, the umbilicus and the urachus, with the two obliterated hypogastric arteries were excised. The urachus was small and cordlike in structure with no evidence of tumor formation. Grossly, it was not possible to establish the presence of a lumen in the urachus. The peritoneal cavity was not opened. Pathological examination of the specimen revealed a cyst of the umbilicus approximately 1 centimeter in diameter which drained a sinus originating in a patent urachus. The lumen of the urachus was ½ to 1 millimeter in diameter throughout its entire length. The bladder was irrigated, following the operation, with great improvement and the patient was discharged from the hospital apparently cured.

It is difficult to say just what relation the persisting urachus could have had with the severe cystitis in this case. From the history, the bladder symptoms appeared at about the same time that the umbilical discharge was first noticed. That there was a definite relation between these two conditions seems fairly certain, as the bladder condition rapidly cleared up with the excision of the fistulous tract and with bladder irrigations following the operation. It is our belief that the patent urachus harbored a low grade infection and that this constituted the source of infection for the bladder and that the vesical symptoms promptly disappeared following the eradication of this focus of infection.

Large cysts, infected cysts, cysts with fistulæ or with neoplastic degeneration are the only ones which we consider surgical. Probably the largest known cyst of the urachus was Rippman's case reported by Cullen. The mass filled the abdomen and contained 52 liters of fluid. The larger cysts may be pedunculated and extend into the abdominal cavity. Means (6) reports a case of a young man 32 years of age, who for 3 months had

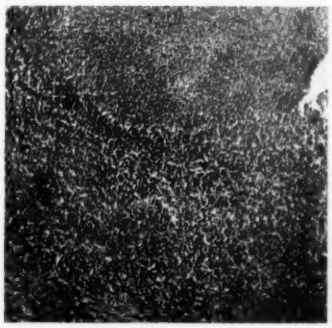

Fig. 3.

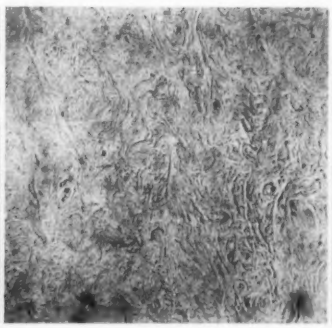

Fig. 4.

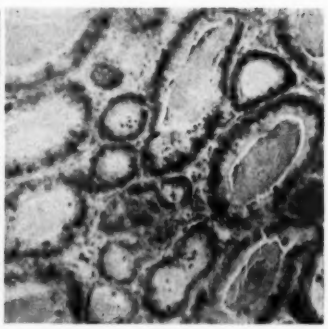

Fig. 5.

Fig. 3. An occasional foreign body giant cell, numerous plasma cells, and fibrosis in the old chronic area, and many polymorphonuclear leucocytes and some necrosis. (X 70.)

Fig. 4. Fibroma. (X 120.)

Fig. 5. Showing spaces, variable in size, lined with pseudo-stratified columnar epithelium, and within the lumen exudate of serum and red blood cells. Adenoma. (X 120.)

been troubled with a sensation of pressure and soreness in the lower abdomen between the symphysis and the umbilicus. The patient had felt a mass some time before, which was definitely palpable at the time of his examination. At operation, a large pedunculated cyst was found hanging free in the abdominal cavity and completely covered with peritoneum. The cyst was removed with the remnants of the urachus to which it was attached.

Abscess and infection of a cyst or a patent urachus may give a train of constitutional symptoms suggesting infection, but the location of pain, which is usually present, gives the clinician an indication as to the probable cause of the trouble. The abdominal pain at times is exaggerated by deep breathing and may be more marked when the patient is walking erect. There may be chills and fever, anorexia, loss of weight, and indigestion. In some, the abdominal pain is the predominant complaint and is usually located in the midline between the umbilicus and symphysis. Diarrhœa has been reported as a symptom, although it is rare. Usually, there are few or no bladder symptoms present, unless the infection has spread to the perivesical structures or the infection has produced a secondary cystitis. An abscess is usually adherent to the posterior rectus fascia in front and to the peritoneum behind; and if the infection is acute and extensive, the omentum nearby may be adherent to the parietal peritoneum.

Case 2. Mrs. P. B. G., aged 55, presented herself, complaining of rectal trouble, tumor in the abdomen and a discharge from the navel. This trouble began about 10 years previously when a doctor found an abdominal tumor. An operation was advised but was refused. About the same time the umbilicus began to drain pus and blood and ever since that time the navel has drained at irregular intervals. There was usually a scab at the site of the drainage and when it was removed, pus and blood would escape from the navel. There had been no increase in the size of the abdominal tumor and it had never been tender, although she had noticed that she would feel better when walking stooped slightly forward. Six years previously she had had a purulent and bloody discharge from the vagina for a few weeks, which she said was of the same character as the drainage from the umbilicus.

The physical examination was of a fairly well developed and nourished individual. There was an abdominal tumor midway between the symphysis and the umbilicus, apparently with no attachment to the uterus, which seemed to be connected to the abdominal wall and the umbilicus. The tumor was more to the left side than in the midline. There was a small sinus at the navel which was discharging small amounts of purulent and necrotic material, and the surrounding skin was reddened, thickened, and excoriated. The urine showed some albumin and a large amount of pus. The blood count was entirely normal and the Wassermann was negative. Roentgen-ray examination of the large bowel showed a spastic colon. Proctoscopic examination revealed a few small internal hæmorrhoids and the mucous membrane of the anal canal was very friable and easily torn.

At operation, an incision was made from the symphysis up to and encircling the umbilicus. The mass was apparently in the abdominal wall and extended more to the left side than to the right. The

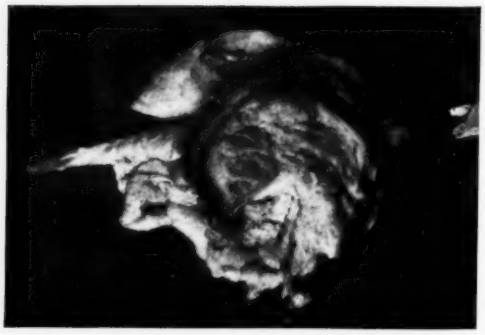

Fig. 6. Photograph of specimen showing urachus with mass and excised bladder wall attached. The specimen has been in preserving fluid.

peritoneum was opened and the tumor mass which was about 12 centimeters long and 10 centimeters wide, was removed with a large portion of the right rectus, and about two-thirds of the left rectus muscle together with the peritoneal attachment. The omentum was firmly adherent to the parietal peritoneum. The omentum was resected and tied off, the dome of the bladder to which the tumor was attached at its lower pole, was removed in a circular incision, and a piece of the bladder approximately 5.5 centimeters in diameter was excised.

The pathological examination revealed an abscess of the urachus. The mass removed measured 12 by 8 by 8 centimeters with peritoneal and omental attachment on its posterior surface and the bladder attachment at its lower pole. On serial section of the mass, an abscess cavity 4 by 3 centimeters was found in the central portion. The walls of the cavity were from 4 to 6 centimeters thick and on microscopic examination showed an acute infection on a dense and ancient inflammatory process without evidences of malignancy (Fig. 3). The patient died from peritonitis the eighth postoperative day. No postmortem was permitted.

It is interesting to note the postural relief in this case. The patient said that she felt better if she walked stooped slightly forward. This fact has been noted in a number of instances. Arrou reported the case of a soldier who had this same postural relief. Ward (11) reported a patient who had a suppurating cyst of the urachus and who experienced relief from pain when he walked stooped forward. Davis also reports a case in which there was relief of pain when the patient was lying with the legs flexed on the abdomen. It is interesting that such a tumor of the abdominal wall could persist so long and apparently without change. The patient said that there had been no change in the size of the mass since it was first noticed. If this had been infected for this long period, it must have been a very low grade type, and the tissues had continued to handle this burden without difficulty. There was no doubt but that this was an infected urachus, as the location was exact and its anatomical connections distinct.

Case 3. While the diagnosis was not proved at operation, it seemed certain. Baby R. F., female, aged 20 months, was apparently a normal baby at birth, being the first child of healthy parents. The delivery had been normal. At 12 months of age, the patient had several abscessed glands of the neck, which were drained operatively and were considered by the home doctor as tuberculous. The child had been perfectly well after this until 10 days prior to admission when she awoke out of a sleep with a fever of 104 degrees, vomited and appeared to be sick. She then seemed well for the following 4 days, then became very restless and constipated and mineral oil and milk of magnesia were used with some improvement in the condition. On the fourth to fifth day after the onset, she again had fever of 102 degrees and vomited. At that time the abdomen was distended and has remained so ever since. For 7 days there had been a temperature of from 99 to 103 degrees. The physical examination revealed a well developed and nourished baby with no apparent adenitis. The abdomen was markedly distended and there was definite spasm of the rectus muscles. Around the umbilicus and involving it, was a reddened area about 3½ centimeters in diameter. The urine showed a slight amount of albumin, an occasional red blood cell and many pus cells. The white blood count was 18,800 and the hæmoglobin was 53 per cent. On cystoscopic examination a diagnosis was made of the right renal tuberculosis and possibly of the left kidney. At the time of cystoscopy an opening into the bladder near the dome was seen and a diagnosis was made also of a patent urachus. After 4 days of hot dressings, the umbilicus began to drain large amounts of foul, thin pus. A probe passed into this sinus would take a downward course toward the symphysis for a distance of about 5 to 6 centimeters. This patient was in the hospital for several weeks and improved greatly. It was felt that the condition was too acute to warrant radical treatment.

This case was certainly one of an abscess of a patent urachus complicated with renal tuberculosis, and unfortunately we have been unable to follow it. In view of the past history of suppurative adenitis and the clinically tuberculous condition present, the possibility of a tuberculous urachus must be considered. This was not proven, although it must enter into the differential diagnosis.

Powell (9) reports the case of an abscess in a patent urachus in a child 9 months old. This child was of a normal confinement. The umbilical cord separated the ninth day but the wound never completely healed. The child always cried when voiding and the urine showed blood, pus, and albumin. There was tenderness over the lower abdomen and a small globular mass was palpable in the mid-

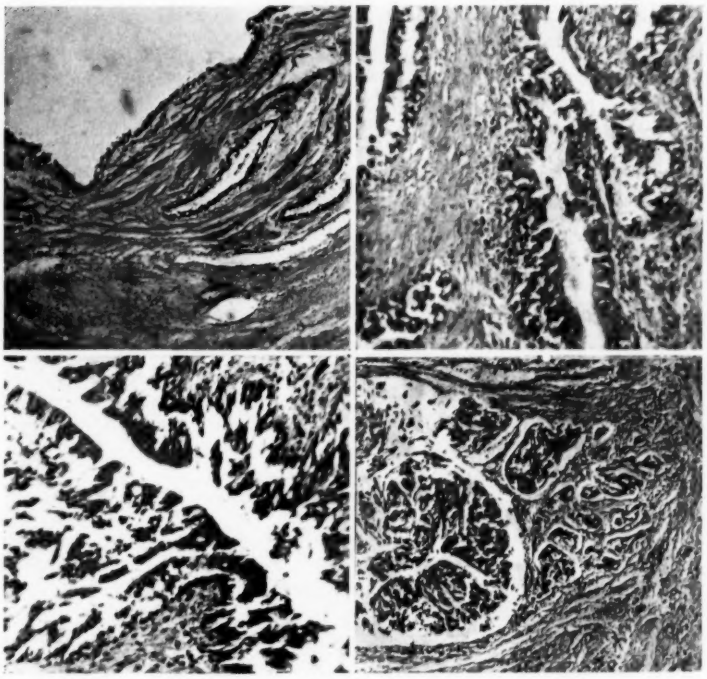

Fig. 7 (above, left). Showing urachus 2.5 centimeters above tumor mass. No evidence of malignancy. (X 60.)

Fig. 8 (above, right). Showing urachus 1.5 centimeters above bladder attachment with malignant degeneration of epithelium. (X 120.)

Fig. 9 (below, left). Showing malignancy in urachus 0.5 centimeter above bladder attachment. (X 120.)

Fig. 10 (below, right). Showing section taken at the edge of tumor mass in the bladder wall. Atypical glandular arrangement is shown with invasion into surrounding tissues. (X 60.)

line just above the symphysis. Occasionally the mass enlarged and extended and at such times there was fluctuation. An abscess of the urachus was diagnosed. This was drained through the incision directly over the mass, and an uneventful recovery followed.

Eastman (3) reported the case of a 19-year-old woman who had pain, heat, and redness about the umbilicus for 5 weeks, associated with bladder tenesmus and frequency. There was a spontaneous opening at the navel and from that time on, all the urine drained from this sinus. At operation a mass with the fistula was excised and microscopically was found to be tuberculous. He believes this condition was primary in the urachus.

He reports also a second case of tuberculous urachus. A woman 19 years of age had been troubled for 3 months with pain and a small swelling between the symphysis and the umbilicus. At operation, a fistula was found extending down into the space of Retzius and to the bladder. Microscopically, miliary tuberculosis was found. For months there was a purulent drainage from the wound. Examination of the urine, chest, abdomen, and bladder were negative.

When abscesses of the urachus are treated surgically, preferably by drainage, a large percentage of them will be cured. If an inflammatory mass is present, excision is necessary and should be done without opening the

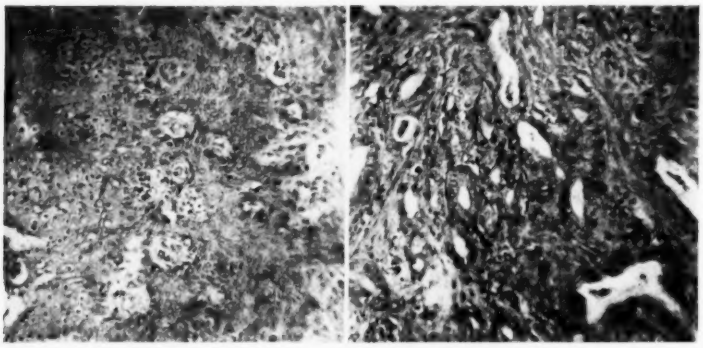

Fig. 11 (left). Showing stratified epithelium and fairly thick layer of cornified epithelium in outer portion. (X 120.)

Fig. 12. Showing masses of undifferentiated epithelial cells arranged in glandular formation and invading the underlying tissues.

peritoneum if possible. If there has been a long standing infection the parietal peritoneum is usually adherent to the under surface of the mass and it may be impossible to remove it without opening the peritoneal cavity. Under these conditions the gravity of the operation is greatly increased because of the possibility of contamination, as in Case 2. Expectant treatment, drainage, and hot fomentations can be instituted and the mass extirpated when the infection has subsided.

CASE 4. Mrs. E. C. A., aged 45, came because of an indefinite history of abdominal bloating, gas, belching, and constipation. She had had a few abdominal attacks of pain which were indefinite in character. She had lost about 20 pounds of weight in 4 or 5 months. General physical examination was negative save for slight tenderness over the gall-bladder region. The examination of the urine was negative. The gastric analysis showed total acids 42, and free hydrochloric acid, 24. A diagnosis was made of chronic cholecystitis and appendicitis. At the time of the operation a small mass was felt in the midline below the umbilicus, which seemed to be between the peritoneum and the muscles of the abdominal wall. Upon exploration the mass was found about the size of a hen's egg, adherent to the tissues below the umbilicus and apparently originating in the urachus. This mass was easily extirpated and the wound closed. Pathological examination established a diagnosis of fibroma of the urachus (Fig. 4). It was attached to the upper termination of the urachal tube which presented as a cordlike structure, ending in the tissues of the umbilicus and just above the peritoneum. Fibromata and myomata of the urachus are rare and little in the literature has been written on them.

CASE 5. Mr. C. W. McD., aged 46, had had typhoid at 19 years of age, a Neisser infection years ago, and a chancroid 8 years ago. He presented himself complaining of bladder trouble. Two years previously, while lifting a heavy weight he had a sharp pain in the right lumbar region. Two days later he noticed blood in the urine, which has been present at irregular intervals ever since. He said he had passed gravel and pus in the urine 6 months ago. Three months ago he passed some fleshy masses in the urine and at the same time he had several colic-like pains and marked frequency of urination. These pieces of tissue were taken to a doctor, who after microscopic examination, said they were cancer. Since the onset, he has had marked frequency of urination, with pain at the end of micturition when he passes blood and pus. He has had a bearing down pain in the lower abdomen and has lost 20 pounds of weight in the last 2 years. The patient was a very thin and poorly nourished man. There was a tender mass palpable just above the symphysis and with one finger in the rectum it was felt as a through-and-through mass just above the prostate. The rectal examination was very painful. Urinalysis showed a moderate amount of albumin, red blood cells and pus. No tubercle bacilli were found in the urine. The hæmoglobin was 90 per cent. Roentgen-ray plates of the kidneys, ureters, and bladder were negative. Cystoscopic examination revealed a multiple diffuse papilloma covering the roof and upper wall of the bladder, multiple based, resembling exaggerated granulation tissue areas, as though of prevesical origin. A clinical diagnosis was made of tumor of the bladder. At operation a suprapubic exposure of the bladder was made. There was a tumor involving the lower end of the urachus and the dome of the bladder. The dome of the bladder with the urachus attached was removed. The mass measured 8 by 8 by 6 centimeters. The urachus measured 9 centimeters in length, it was 1.5 centi-

meters at its greatest diameter, and 3 millimeters in diameter at the tip, and the tumor involved its lower third. To the lower pole of the mass was attached the excised portion of the bladder. The entire mass was markedly lobulated, moderately firm and fairly well circumscribed; the gross appearance gave the impression of malignancy. Upon microscopic examination it was found to be an adenoma, extending into the dome of the bladder (Fig. 5).

This case is of especial interest, as it is quite similar to one of the cases reported by Schwarz (10).

Schwarz's patient was a man, 57 years of age, who after a fall, noticed pain on urination and hæmaturia. At intervals afterward he had noticed blood in the urine, and at one time had passed fleshy masses. This continued for a year before he presented himself for examination. It was impossible to palpate any abdominal mass because of marked obesity, but there was an area of dulness between the symphysis and the umbilicus. Urinalysis showed many pus cells and a few epithelial cells. The cystoscopic examination revealed an area about the size of a 10 pfennig piece at the apex of the bladder, with mucous membrane of unusual appearance, which was described as a "defect in the mucous membrane." A diagnosis was made of an extravesical tumor. The operation was performed by Prof. Perthes. A mass the size of a goose's egg was found in the space of Retzius, which crowded the bladder downward and backward. The tumor was freed easily from the anterior structures, but was adherent posteriorly, had perforated the peritoneum and was intimately connected to the apex of the bladder. From the upper pole of the tumor was a cordlike structure running to the navel. The tumor was removed together with a circular portion from the dome of the bladder and the peritoneal attachment. The bladder and peritoneum were closed, the bladder drained with a retention catheter, and the space of Retzius drained with a small rubber tube. The patient was dismissed from the hospital the fifteenth postoperative day in good condition. The pathological report was adenocarcinoma of the urachus with attachment to the dome of the bladder.

These two cases are similar in several respects. The symptoms occurred after some physical exertion, in one a fall and in the other the lifting of a heavy object. There was pain in both, interval hæmaturia, and the passing of fragments of tissue. The cystoscopic examination in the 2 cases was similar, an unusual appearing mucous membrane in the dome of the bladder; and in each instance the deduction was made that the original tumor was probably intravesical in origin. While in the case of Schwarz's patient, the diagnosis was carcinoma and in ours it was adenoma, the clinical signs were in many ways the same. The first thing that drew serious attention to the trouble was blood in the urine and this obviously must have come from some place within the urinary tract. Here then must possibly be a life-saving factor, that these tumors invade the bladder or cause pressure upon it and give rise to vesical symptoms. Were this not so and in the absence of pain, the growth might go on to such an extent that operative procedure would not give a cure, as metastasis or the direct extension would have rendered the tumor inoperable. In view of the lack of physical findings, the cystoscopic examination was the only means by which the diagnosis was made possible.

Case 6. Mr. C. W. L., aged 66, presented himself complaining of kidney trouble. He denied venereal infection; and the family and past histories were negative. The complaint dated back 27 years, when he had a sudden and severe colic in the lower abdomen, radiating around to the back, associated with nausea, vomiting, and with blood and clots in the urine. He had no further trouble for 12 years, when he had a recurrence of the same type of attack with blood and clots in the urine. He was then free from trouble until a few weeks prior to his admission, when he had the third attack, identical in nature to the other two. Since the last attack, he had had blood and clots in the urine, and a few mild attacks of lower abdominal pain. There had been marked frequency of urination and the patient had lost 30 pounds in weight in 5 years.

The physical examination showed an old man who had apparently lost considerable weight and had marked arteriosclerosis. The Kolmer reaction was positive 44. Urinalysis revealed a large amount of albumin and red blood cells and a small amount of pus. The urine was stained for spirochætes, but none were found. The blood count showed hæmoglobin 58 per cent, red count 5,780,000 and white count 9,800. The phenolsulphonephthalein return was 50 per cent. Roentgen-ray plates of the kidneys, ureters, and bladder, as well as of the chest were negative. Cystoscopic examination, done March 23, 1923, showed an area on the anterior portion of the dome of the bladder of indefinite size which was irregular, necrotic, and covered with blood clots. Clear urine was seen coming from both ureteral openings. A small piece of tissue was taken for examination and was reported by the pathologists as "inflammatory." On April 3, another cystoscopic examination was made and at that time the mass could be determined to be about 4 by 3 by 3 centimeters in size. It was ulcerated, irregular on the surface with the edges circumscribed, and bled easily. The tumor was of an unusual type and in view of the

positive Kolmer reaction, it was necessary to consider the possibility of a gumma. The patient was given an intensive course of salvarsan treatment and a third cystoscopic examination was made May 2. At this time, the tumor gave the appearance of a Grade III epithelioma and its position made it favorable for resection. The unusual appearance of this growth gave the impression that it was a tumor of the urachus secondarily involving the bladder.

At operation, a suprapubic incision was made, exposing a growth in the space of Retzius. The tumor was about 4 centimeters in diameter and apparently originated in a persisting urachus at a point near the dome of the bladder and involving it. The mass with its bladder attachment, together with about 1 centimeter of normal bladder wall around the periphery of the growth, and the entire urachus were removed. It was necessary to open the peritoneum because of the posterior attachment. The peritoneum was closed and the bladder reconstructed with an inner row of plain catgut and an outer row of chromic catgut. The pathological examination showed a tumor of the lower end of the urachus with the involved bladder dome attached. The mass measured 4 by 3 by 2 centimeters and the urachus was 12 centimeters long. The greatest diameter of the urachus was 1.5 centimeters at its lower end and the least diameter at its tip was 5 millimeters. Microscopic examination revealed a squamous cell epithelioma of very malignant looking cells (Figs. 7, 8, 9, and 10). The patient died 7 months after the operation from recurrence. Up to the time of his death, there had been no urinary symptoms, but there had been 6 local recurrences to the right of the midline and just above the symphysis. These recurrences gradually enlarged, each to reach the size of a man's fist. There had been marked emaciation before death occurred but the patient had not permitted further treatment for the recurrences. No postmortem examination was permitted.

This case is of especial interest in view of the long history. Yet the clinical progress in general is the same as that in the case of the adenoma of the urachus reported and similar to the case reported by Schwarz. Here we have a 27-year history of abdominal pain, interval hæmaturia, with long periods of freedom, one of these periods being 12 years. In the 27 years he had three outstanding attacks of pain and hæmaturia, and in the few weeks prior to his examination, the attacks were quite frequent. Clinically, the positive Kolmer reaction threw some doubt upon the nature of the tumor, but the subsequent operative findings and the microscopic examination established without doubt the pathological diagnosis. As in the other 2 cases which were mentioned, the cystoscopic picture of the bladder growth was unusual and the preoperative suggestion was made that the mass might be of extravesical origin. Metastases in malignancy of the urachus occur late in the disease while the spread of it is usually by direct extension and local recurrence, as in this case.

Khaum (5) reports Hoffman's case, a man 28 years of age, who had had a patent urachus since he was 3 years of age.

At the age of 27 patient noticed a hardness between the symphysis and the umbilicus, movable but not tender. The mass had gradually enlarged and he had dysuria, weakness, loss of weight, and had become emaciated. On examination, the tumor, which was about 10 centimeters long, was found nodular, adherent to the umbilicus and painful. The urine contained a moderate amount of pus and epithelial cells. The mass became fluctuating and ruptured, discharging a large amount of purulent, bloody fluid, but there was no change in the size of the tumor. The discharge contained many epithelial cells with pearl formation which subsequently proved to be squamous cell epithelioma.

Cullen mentions a similar case reported by Fisher. In this instance, a mass was at first thought to be an abscess and was operatively drained. Small balls of material were seen in the pus which proved to be squamous cell epithelioma. Both of the cases mentioned came to autopsy and in each instance the malignancy was found to be primary in the urachus.

Khaum says that true retention cysts of the urachus are rare, because the mucous membrane of the urachus is similar to that of the bladder and has no definite secretory function. The same obscurity exists in regard to the exact origin of carcinoma. Schwarz says that he has never found glands in the urachus, but he has found structures in the vortex and the trigonum lieutaudi of the bladder which resembled gland formation. It occasionally happens that a carcinoma of the bladder is found which resembles the colloid carcinoma of the rectum. Rauenbusch in 10 years collected 65 cases of carcinoma of the bladder in males, and of these, only 1 case was a colloid type of carcinoma, while in only 10 cases of carcinoma of the bladder in females, he found 1 instance of colloid carcinoma. How

can we account for the origin of carcinomata, especially of the colloid type, in the bladder or urachus in which normally there are no glandular structures? If the mucous membrane of the urachus and the bladder arise from the same origin, why are glands not found in each? It may be that by some process of metaplasia pseudo-gland formation is built up and malignancy superimposed upon them. The bladder and urachus belong embryologically close together and develop from the embryonic rectum, the epithelial coat of which they carry with them. Therefore, it is not entirely strange that occasionally gland formation may exist and give rise to a malignant process. Another factor which should be considered is the close proximity of the vitelline duct to the urachus during development. This causes us to wonder if there could be any connection between these two structures in the production of neoplastic growths.

CASE 7. Mr. J. G., a farmer of 68, came because of "stomach trouble." The family and past histories were negative. For years the patient had complained of belching, gas, and some constipation. Three months ago he noticed an irritation about the umbilicus which became reddened, hard, and at times slightly tender. There were occasional sharp pains in this region, but they were never severe. Local treatment had been tried, but without relief. The general physical examination was negative save for an ulcerated area about the umbilicus. Urine, blood, and Wassermann examinations were negative. A clinical diagnosis was made of infected umbilicus.

At operation, an elliptical incision was made to include the portion of the umbilicus above the aponeurosis. The aponeurosis was then split and there was found to be a thickened mass of tissue immediately below the linea alba. This mass was about the diameter of a 25-cent piece and the tissue looked malignant. There was no evidence of metastasis or of direct extension of the growth. The pathological specimen of the umbilicus and surrounding tissues removed measured 8 by 8 by 2 centimeters. The skin was markedly thickened, being 1.5 centimeters thick. It was very hard and fibrous with gross bands of connective tissue throughout the entire mass.

Sections (Figs. 11 and 12) taken from the tumor showed adenocarcinoma and from the location and arrangement of the growth, it appeared that it originated in the urachus and not in the umbilicus. The patient received three radium treatments over the operative site, the dosage totaling 7,656 milligram hours. In about 3 months there were local recurrences. The patient refused further treatment and died September 20, 1921. No postmortem examination was permitted.

Because of the location of this tumor and the fact that the tumor was definitely identified as a part of the urachus which could be easily seen, it seems that this mass originated within the urachus. It did originate near the umbilicus, and discharge through a sinus at the navel and this fact seems against including it as a urachal tumor.

It is more common to find the tumors of the urachus in the lower half and as Cullen says, usually in the lower third. Figure 11 shows a layer of stratified epithelial cells with a fairly thick layer of cornified epithelium in the outer portion. Figure 12 shows areas of undifferentiated epithelial cells in glandular formation invading the underlying tissues. It is impossible to say whether this was primarily a squamous cell epithelioma of the umbilicus which extended into the tissues below and by a process of metaplasia gave the picture of an adenocarcinoma, or primarily an adenocarcinoma of the urachus with a change in its pathological picture as it extended to the cutaneous tissues. This typifies that group of cases in which a fine line of distinction cannot be drawn between tumors of the umbilicus and those of the upper part of the urachus.

REFERENCES

1. CULLEN, T. S. The Umbilicus and Its Diseases. Philadelphia: 1916.
2. DAVIS, B. F. Cysts of the urachus. Surg. Clin. Chicago, 1919, iii, 521.
3. EASTMAN, J. R. Tuberculosis of the urachus. Am. J. Obst., lxxii, 640.
4. GIBB, W. T. A case of patent urachus with abscess complicating an hypertrophic prostate. Med. Rec., 1918, xciii, 491.
5. KHAUM, E. Ueber ein primaeres Karzinom des Urachus. Wien. klin. Wchnschr., xxix, 130.
6. MEANS, J. W. Cysts of the urachus. Ann. Surg., lxiv, 53.
7. MORSE, H. Personal communication.
8. PAGET, T. A case in which the wound remained open and a calculus formed. Med. Clin. Tr., 1850, xxxiii, 293.
9. POWELL, R. E. Abscess in a patent urachus in a child 9 months old. Canadian M. J., x, 675.
10. SCHWARZ, E. Das Carcinom des Urachus. Beitr. z. klin. Chir., 1912, lxxviii, 278.
11. WARD, W. G. Suppurating cyst of the urachus with concretions. Ann. Surg., lxix, 329.
12. WEISER, W. R. Cysts of the urachus. Ann. Surg., 1906, xliv, 529.

SECTION OF THE LEFT VAGUS FOR RELIEF OF ASTHMA[1]

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VAGUS section in bronchial asthma is a new and little tried procedure. It is desirable, therefore, to put on record all instances in which this operation is performed in order that a true valuation of the procedure may be reached. For this reason a case is reported in which vagus section was followed by only slight improvement.

The patient who is the subject of this report is a man 63 years old. His past medical history is negative for any other manifestation of hypersensitiveness, but a niece is asthmatic. He had been perfectly well until March, 1923, when in the course of an attack of acute bronchitis he suddenly developed a wheezing dyspnœa that persisted and after several months forced him to give up his work and go to bed. At first the dyspnœa was fairly constant, but in September, 1923, 6 months after the onset, it began to be worse in paroxysms. These attacks came several times a day with no obvious relation to any special cause and could be relieved by injections of adrenalin. At this time he was admitted to a hospital where he remained for 7 months. Various examinations were made and the usual measures for relief attempted, but without helping the patient whose condition grew gradually worse. On April 19, 1924, he was transferred to the Medical Division of the Hospital of the University of Pennsylvania.

Examination showed a rather emaciated, cyanotic bed-ridden individual with labored wheezing respiration and frequent but unproductive cough. The nose and throat were congested and several decayed snags of teeth were present in the lower jaw. The chest was markedly emphysematous. The heart was large and the sounds feeble. The blood pressure was 116 systolic and 72 diastolic. There was a moderate secondary anæmia with 70 per cent of hæmoglobin and the leucocyte count varied from ten to sixteen thousand, with eosinophiles ranging from none to 6 per cent. The blood Wassermann was negative. The urine contained traces of albumin and varying numbers of hyaline casts, but the specific gravity had a normal range and tests for renal function gave normal results.

The usual skin tests for hypersensitiveness were performed, using the inhaled substances—feathers, animal hair, pollens, orris root, and house dust—and also the foods included in his diet. All reacted negatively, some of them on two occasions.

Roentgen-ray examination showed a clouding of the ethmoid sinuses on both sides and some abscessed teeth. Attention was therefore first directed to these foci of infection. Thorough operative drainage of the ethmoid region was promptly followed by complete relief from paroxysms for 3 days. When these returned they were believed to be due to blocked drainage. A reopening of the sinuses was again followed by 2 days' freedom from asthma. A third examination showed no local explanation for the recurrence of trouble, but the cocainization of the nose at this time again relieved the patient for a day or so. Later this measure also failed. Vaccines prepared from the sinus pus and from the sputum were used but gave no relief, nor could positive skin reactions to bacterial proteins be obtained. The latter was attempted by the intracutaneous injection of heavy suspensions in salt solution of killed bacteria, the strains recovered from the sputum (a hæmolytic streptococcus, a non-hæmolytic streptococcus and micrococcus catarrhalis) being used separately.

The attacks of dyspnœa in the course of the next 2 months became gradually more frequent; adrenalin alone gave less and less relief, and had to be supplemented by pituitrin and frequently by morphine. At this juncture, sodium iodide was given intravenously, using 10 cubic centimeters of 1 per cent solution, and for a few days it helped considerably. The attacks were less frequent and yielded more readily to adrenalin.

But again the relief was only transitory so that early in July, 1924, he was requiring adrenalin injections at intervals of 1 hour or less. It was at this time that in desperation we considered the possibility of surgical relief.

The operative treatment of bronchial asthma has received considerable attention in Europe in the past 2 years. Section of the cervical sympathetic was the first operative procedure proposed. In July, 1923, Kuemmell (9) reported his results from unilateral cervical sympathectomy in four asthmatics ranging in age from 23 to 65 years. One case was a failure, but 3 patients were said to be completely relieved. Kaess (6) in 1924 reported 5 cases so treated that they were all still relieved after periods of from 3 weeks to 4 months. Floercken (2) performed this same operation on 4 patients, 3 of whom at the time of reporting were still relieved after periods of 3 weeks to 5 months, while the fourth had temporary relief and then a recurrence of trouble. Von Genersich (10) did a left cervical sympathectomy in a man 64 years old in whom all other

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forms of treatment had failed. For 2 weeks the patient was without asthma; then the attacks recurred with great severity and at the request of the patient the right side was also operated upon. The attacks were now reduced in frequency to one daily. Two months later the costal cartilages on the right side from the second to the fifth inclusive were resected with subsequent relief from asthma.

On the other hand, Jungmann and Bruening (5) reported 3 cases of unilateral cervical sympathectomy with no relief in 1 instance and relief for only a few days in the other 2.

Just why sympathectomy should relieve bronchial asthma has been the subject of much discussion. Kuemmell (9) believes that there is such an interweaving of vagus and sympathetic fibers and consequently of vagal and sympathetic function that vagus and sympathetic should not be considered as clearly separated in an anatomical or physiological sense. Cutting the vagus he considers dangerous, but in cutting the sympathetic he believes that he divides enough vagus fibers to be of benefit. Glaser (4), on the other hand, believes that sympathectomy divides the centripetal fibers of a reflex arc. This opinion is shared by Kaess (6) and Moravity (cited by Glaser). It has also been suggested that there is a lack of equilibrium between vagus and sympathetic in asthmatics, and to this cause Claude (1) attributes the contradictory results obtained when the tests of Eppinger and Hess for vagotonia and sympathicotonia are applied to asthmatics.

But sympathectomy is a rather difficult procedure and needs to be done under general anæsthesia for which we deemed our patient unsuitable. This, together with the uncertainty as to underlying principles and results of sympathectomy, led us to consider vagus section. If bronchospasm is a factor in the mechanism of asthma, then division of the motor nerve supply of the bronchial musculature would have a logical basis. Kappis (7) in December, 1923, reported both unilateral and bilateral section of the cervical cardiac branches of the vagus for the relief of angina pectoris. In May, 1924, Frey (3) in an article calling attention to the possible dangers of section of the nerves innervating the heart, mentioned the fact that vagal section has been performed by Kappis, and had apparently been mentioned by Kappis at some medical meeting shortly before. We have, however, been unable to find a reference to the early work of Kappis, and he gives no journal reference of it in his later paper. However, we did know that the operation had been successfully performed: our next concern was as to which vagus to cut. Section of the left vagus would involve recurrent laryngeal paralysis. On the other hand, the cardiologist told us that section of the right vagus, because of its greater part in the innervation of the heart, might cause trouble from the standpoint of that organ, particularly so in our patient who undoubtedly had myocardial weakness and a tachycardia ranging between 96 and 120.

We chose, therefore, left vagus section with its vocal cord paralysis in preference to a possible fatality from right vagus section. The nature of the operation and its possible consequences were explained to the patient and he gladly consented to try anything that might possibly give relief.

Accordingly, on July 19, 1924, the left vagus was cut under local anæsthesia by Dr. I. S. Ravdin of the Surgical Division of the University Hospital. There was no striking immediate effect. In the 2 weeks that followed, however, the asthmatic paroxysms became somewhat less severe and also less frequent, so that the patient required adrenalin injections at intervals of from 6 to 18 hours only. The pulse rate, to our surprise, was not at all affected at the time of operation, and thereafter gradually fell in the course of 2 weeks to a range between 76 and 100. Figure 1 gives an abbreviated record of pulse and respiration rate during the week before and 2 weeks after the operation.

The blood pressure likewise showed no change, but continued undisturbed around 120 systolic and 70 diastolic. An electrocardiographic tracing made some weeks after operation showed simple tachycardia and a P-R interval of 0.14 to 0.15 seconds. The QRS complexes were of low voltage, indicating a poor functional state of ventricular muscle.

There was no further improvement in the patient's condition. While he was no longer

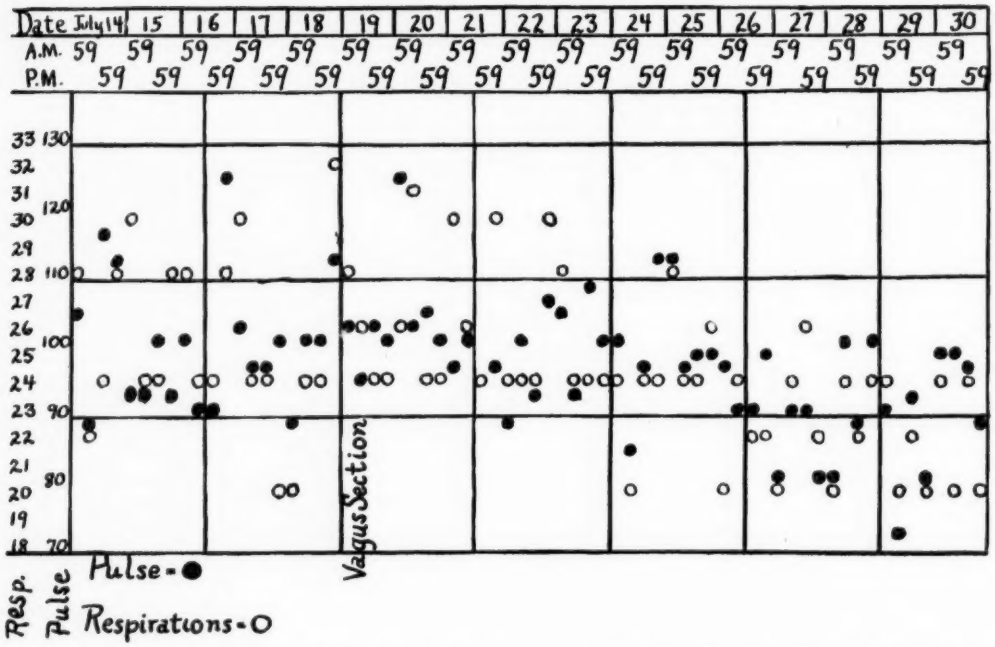

Fig. 1. Chart showing abbreviated record of pulse and respiration rate during the week before and 2 weeks after operation.

bed-fast and gained 5 pounds in weight, he continued to have dyspnœa on slight exertion and from one to three paroxysms of asthma daily. Vaccines, intravenous sodium iodide, local applications through the bronchoscope, failed as before to give relief. A week's stay in a room supplied with dust-free washed air seemed at first to lessen the severity of the attacks but not permanently. The vocal cord paralysis interfered with coughing to some extent and the patient's voice was little more than a hoarse whisper. On January 8, 1925, he was discharged to his home, but 2 months later he was readmitted to another hospital because of difficulty with adrenalin hypodermics. His present condition is practically the same as when he left our wards.

Bronchoscopic findings after the vagus section, as described by Dr. Gabriel Tucker of the Bronchoscopic Clinic of the University Hospital, are of interest. The tracheobronchial movements on the right side were normal; on the left there was more, limited opening and closing of the bronchus. The left bronchus did not collapse on efforts of coughing as was the case on the right side. The secretion in both main bronchi seemed about the same in amount and character. There was apparently no difference on the two sides in response to stimuli as manifested by production of cough. Five months after the operation, the bronchi on the right side seemed to open more widely on inspiration and to show greater excursion in closing on expiration and on cough than did those on the left, although motion was very good on the left side. Left vagus section had apparently not materially reduced the motor nerve supply of the left bronchial tree.

In September, 1924, 2 months after our patient had been operated on, there appeared an article by Kappis (7) in which he described some of his experiences with vagus section. He first performed the operation in January, 1925, cutting the right vagus below the level at which the recurrent laryngeal branch is given off. The results were variable,

some good and some bad. No harmful effects on the heart were noted. One patient died as a result of injury to the subclavian artery at operation. In one patient, a man 64 years old, section of the right vagus gave some relief from asthma but there was considerable unilateral sweating. Kappis then did a sympathectomy on the same side; this was followed by a return of asthma as severe as it had ever been.

In his discussion of the indications for operation, Kappis emphasizes the fact that nerve section in asthma must be looked on as a last resort and with this we heartily agree. As to whether vagus or sympathetic is to be cut, he finds it difficult to say which will help. In an attempt to answer this question he injects either the right vagus or the left sympathetic with novocain and later operates according to the results obtained. He advises against cutting both nerves on the same side, and, of course, against cutting both vagi or both sympathetics. He has noticed some increase of bronchial secretion after vagus section. This was not the case in our patient.

SUMMARY

The history of a patient is reported in whom as a last resort the left vagus was cut for the relief of asthma. The operation was followed by only slight improvement. No harmful effects on heart action were observed. Bronchoscopic examination showed diminished but not lost bronchial motility on the affected side. The subject of the operative treatment of asthma is briefly reviewed. No conclusions are drawn as to the value of vagus section in asthma on the basis of this one case. In view of the experience of Kappis, however, it would seem that right vagus section below the level of origin of the recurrent laryngeal nerve may be safely performed and is, therefore, preferable to cutting the left vagus.

REFERENCES

1. Claude, F. Le tonus vago-sympathique des asthmatiques. Paris méd., 1924, i, 387.
2. Floercken, H. Kritische Beitraege zur operativen Behandlung der Angina Pectoris und des Asthma bronchiale. Arch. f. klin. Chir., 1924, cxxx, 68.
3. Frey. Herznerven und chirurgische Behandlung des Asthma bronchiale. Muenchen. med. Wchnschr., 1924, lxxi, 603.
4. Glaser, F. Die Wirkung der Sympathectomie bei Angina Pectoris und Asthma bronchiale. Med. Klin., 1924, xx, 477.
5. Jungmann, P., and Bruening, F. Zur chirurgischen Behandlung des Asthma bronchiale. Klin. Wchnschr., 1924, iii, 399.
6. Kaess, F. W. Zur operativen Behandlung des Asthma bronchiale. Klin. Wchnschr., 1924, iii, 880.
7. Kappis, M. Die operative Behandlung der Angina Pectoris. Med. Klin., 1923, xix, 1658.
8. Idem. Die Frage der operativen Behandlung des Asthma bronchiale. Med. Klin., 1924, xx, 1347.
9. Kuemmell, H. Zur chirurgischen Behandlung des Asthma bronchiale. Arch. f. klin. Chir., 1923, cxxvii, 716.
10. von Genersich, A. Extirpation des Hals sympathicus bei Asthma bronchiale. Klin. Wchnschr., 1924, iii, 2011.

ECTOPIC URETERAL OPENINGS

Surgical Significance and Treatment

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CONGENITAL malformations of the uropoietic system are of interest both to the student of embryology and to the clinician; to the latter particularly because of the very confusing symptomatology that may be presented for diagnosis and the difficulties that may present themselves in determining the proper procedure for correction of the deformity. Practically all such cases require surgical intervention for relief, if symptoms are present that cause distress or discomfort. Present day methods of urological diagnosis permit such accurate and detailed determination of the conditions present that many of the details of an anatomical anomaly of the kidneys or ureters can be demonstrated in the living, while formerly such details were available only at autopsy. With such detailed information available the decision as to the surgical procedure applicable in any given case is greatly facilitated.

Kelly and Burnam classify anomalous ureteral terminations as follows:

1. In the male genito-urinary apparatus: (1) in the bladder, (2) in the urethra, (3) in the seminal vesicle, vas deferens, ejactulatory duct, or prostate.

2. In the female genito-urinary apparatus: (1) in the urethra, (2) in the vagina, (3) in the vestibule of the vagina, (4) in Gaertner's canal, (5) in the uterus or tubes.

3. In the bowel: (1) in the rectum and cloaca, (2) in the intestines, (3) in the urachus and amniotic cavity.

4. In cases of congenital absence of the bladder: (1) in the urethra, (2) in the vestibule of the vagina.

5. Blind endings.

This paper comprises a study of two patients under the author's observation, each with an ectopic opening of a supernumerary ureter; and a consideration of cases of single and supernumerary ureters with ectopic openings reported in literature, but including only (1) in the male, ectopic openings directly into the urethra, or indirectly into the urethra through the seminal vesicle, vas deferens, ejactulatory duct, or prostate; and (2) in the female, ectopic openings into the urethra or vagina, or on the external genitals. The anomalies included in this grouping comprise a definite clinical entity, and while the symptoms differ to some extent in the male and female, the surgical considerations are practically the same.

The maldevelopments of the uropoietic system exemplified by supernumerary ureters and ectopic openings may be better understood through a brief study of the embryonal development of these structures. Variations in the number of ureters arise through maldevelopment of the ureteral anlagen before the ascent of the kidney out of the pelvis. Early in the life of the embryo, the cloaca represents both the future rectum and the future bladder. It gradually becomes divided by a vertical fold into two compartments; with the anterior of these the allantois and the primitive excretory ducts are connected, while the posterior develops into the rectum.

Entering the cloaca from the dorsal aspect are the two wolffian ducts, which furnish the parent structures of the renal pelvis and the ureters. The wolffian duct, originally developed from the pronephros, is throughout the greater part of its existence the excretory duct of the wolffian body or mesonephros. From these two primitive structures are developed most of the genito-urinary system.

The ureter arises as a process or evagination from the hind wall of the lower end of the wolffian duct. The distal portion of this anlage divides into two branches (representing the primary division of the pelvis into two major calyces), which grow into the developing kidney blastema. Each branch divides again dichotomously and this process of branching is repeated until the calyces and straight uriniferous tubules are produced. The evagina-

tion of the ureteral anlagen dates back to the third or fourth week of embryonal life, before the lower portion of the duct becomes widened and drawn into the urogenital sinus.

Of the several theories that have been advanced to explain the formation of double ureters, one of the most acceptable is that, instead of a single evagination from the wolffian duct, there are two or more anlagen and each of these develops into a separate ureter with a separate implantation into the developing kidney blastema. This theory would explain the formation of a complete ureteral duplication but not of an incomplete one. The development of the latter type of anomaly may be explained by considering a precocious branching of the original evagination before the distal ends became embedded in the nephrogenic tissue, the point of juncture of the two ureters depending upon the period of embryonic development at which the division of the ureteral anlage occurred.

Through expansion of the lateral portion of the allantois the lower end of the wolffian duct becomes dilated and the lower ureter is the first to reach the allantois, thus determining the site of entrance to the bladder, which usually is at the normal insertion of a single ureter. The wolffian duct carrying the upper ureter with it, shifts with the urogenital sinus in a downward direction between the allantois and the rectum, until the second ureter also becomes implanted in the bladder. Thus the ureter from the upper portion of the kidney is always inserted at a point lower than the insertion of the ureter from the lower renal pelvis. If the two ureters are liberated in close succession, they will be found close together in the bladder; if a longer interval prevails, they will be further apart, even to the extent of the upper ureter opening below the bladder. Meanwhile the kidney ascends from the pelvis into the lumbar region—the ureteral tube lengthening as the kidney ascends.

Variations in position of the lower end of the ureter. At first the ureter opens into the lower end of the wolffian duct, but later becomes detached from the duct and attached to the allantois and thus to the future bladder. But if the ureter does not separate from the wolffian duct but accompanies that canal in its downward course, there may result an abnormal opening of the ureter into the vas deferens, seminal vesicle or ejaculatory duct in the male, or into the rudimentary Gærtner's duct in the female—these organs being derived from the wolffian duct. If the ureter after the sixth week of embryonic life still remains attached to the duct, the ureteral openings may be found in the sinus urogenitalis and the organs developing out of this; namely, in the upper portion of the urethra or the prostate in the male, in the urethra or the vestibule of the vagina in the female. If the ureter does not remain isolated from the Muellerian tube in the female, the opening may be in the uterus or in the vagina.

Thus an otherwise normal ureter may have an ectopic opening, a supernumerary ureter may empty into the bladder beneath the normal ureteral opening, a supernumerary ureter may have an ectopic opening while the normal ureter ends in the bladder, both normal and supernumerary ureters may have ectopic openings or ureters separate at the kidney may join to form a single tube before reaching the bladder and any combination of these abnormalities may co-exist when there is bilateral involvement.

SYMPTOMS

In the female the type of symptoms is governed to a large extent by the site of the ectopic opening. When the opening is on the vulva or about the external meatus or in the vagina, the symptomatology is definite and characteristic. From birth there is constant dribbling of urine beyond control and without sensation, in addition to which urine is voided at normal intervals, in normal amounts and in response to the normal impulse of a filled bladder with complete relief on completion of the act.

The history alone should lead to a ready diagnosis, but apparently the condition goes unrecognized for years; in most instances the patient suffering keenly from the humiliating deformity and subjected to very definite social and economic handicaps. Being congenital, the conditions naturally are present from birth, but appreciation of the presence of an abnormal condition occurs when wetting continues

and persists beyond the age when the normal child has learned to control the bladder functions.

If the ectopic opening is in the vagina or about the external meatus, it can usually be identified, if searched for carefully, and a small ureteral catheter introduced. When this is possible the elicitation of the further details entails no great technical difficulties. A word of caution is here necessary. If, in the course of an examination, the bladder is catheterized or a speculum is introduced into the vagina, the leakage from the ectopic opening may cease entirely as the pressure of the catheter in the urethra or the speculum in the vagina may be sufficient to completely block off the flow of urine from the supernumerary ureter.

If the vagina is tamponed with pledgets of cotton and methylene blue is given by mouth or indigo-carmine injected subcutaneously or intravenously, the dye may be eliminated in the urine from the anomalous kidney and the stain on the cotton may be a very considerable aid in localizing the ectopic opening.

If the ectopic opening is in the urethra, the symptoms are dependent upon the course of the ureter. If the latter enters the bladder wall, and passes downward beneath the vesical and urethral mucosa, the constriction of the musculature at the bladder outlet may exert sufficient pressure to prevent the escape of urine from the ureter except during the act of micturition, under which conditions no symptoms would be noticed by the patient and the anomaly would remain unnoticed.

However, when the course of the ureter is such that it escapes the constricting influence of the vesical outlet, constant leakage occurs, exactly the same as when the opening is in the vagina or near the external meatus.

Furniss reports one case in which the opening was not identified, either before or after operation, although the diagnosis was definitely established at the operation and the incontinence cured.

When this difficulty of identification and localization of the opening obtains suggestive data may be obtained by careful cystoscopic and pyelographic examination, since the pelvis and ureter communicating with the bladder on the side of the supernumerary ureter may be found to differ in size, shape, and position from the pelvis of the opposite side and thus warrant surgical exploration for more detailed examination.

In the male the condition usually exists unrecognized unless the existing hydronephrosis is complicated by infection, when increased temperature, pain, swelling, etc., will be noted.

In the male but two cases have been diagnosed during life, Chute recognizing one case during an operation and Day making a complete pre-operative diagnosis. Erlach, Handl, Mesley and Veau, Obici, and Rech, each report autopsy findings in male subjects in whom no symptoms referable to a urinary anomaly had been noted during life.

Peacock reports an autopsy on a male child who had been well until he was 6 months old except that he never urinated freely. From then until his death at 9 months he lost in weight from 24 to 11 pounds. During this period the abdomen showed increasing distention and was hard and tender. The urine looked like milk and had an offensive odor. Convulsions occurred a few hours before death.

Day reports a young man free from symptoms until several hours after wrenching his back in a fall when a sudden sharp pain was noticed in the left lumbar region. The urine became blood tinged and later was loaded with pus. Fever was present for a few days and during the ensuing month he lost 15 pounds in weight. On admission to the hospital he complained of malaise, inability to work, dull pain in the left upper abdomen, and discomfort in the back.

Chute's patient had no sign of prostatic or periurethral infection, but could squirt out several drops of pus from the urethra by straining after the bladder had been emptied. Pain occurred in the left side when a retention catheter was placed in the bladder, the pressure of the catheter apparently preventing the escape of pus through the ectopic ureter.

Some variations from the characteristic symptoms have been noted in the female.

Hunner's patient suffered for 7 weeks from symptoms simulating stone in the right ureter but had never noticed any incontinence. The kidney was found to be replaced by a pyonephrotic sac.

Judd reports a woman 21 years old with diurnal enuresis all her life and nocturnal enuresis when younger but not during her recent years. The dribbling in this instance was not constant but occurred only when she stood or became excited. Three attacks of sharp colic-like pain in the right side of the abdomen, each attack lasting 2 or 3 days, had been diagnosed as appendicitis.

Kelly and Burnam report one case in which the supernumerary ureter was almost functionless, the discharge occurring only at intervals, but the patient suffered much pain at the neck of the bladder.

Juvara reports a woman entirely cured after operation, who for years had a small ulcer on the right side of the meatus from which clear fluid escaped. There was also tumefaction of the entire vulva and the condition had been considered a chronic tuberculous lesion because of a tuberculous trait in the family.

Kakuschkin's patient, a woman of 31, had suffered all her life from a typical incontinence. One year after a confinement, fever occurred suddenly with the formation of a tumor in the right side of the abdomen and retention of urine. The fever subsided and the incontinence was replaced by a purulent leucorrhœa, the pus escaping from the ectopic ureteral opening on the anterior vaginal wall. The change in the character of the secretion from the ectopic opening was evidently due to the occurrence of the pyelonephritis.

Kallmann's patient had been incontinent from infancy but continent for some time preceding operation. The supernumerary ureter ended in a blind sac behind the bladder wall. An ectopic opening was not found, Kallman concluding that, in the absence of secretion, the minute orifice would escape even a very detailed and careful examination. This is the only instance found in which the incontinence ceased spontaneously and it is interesting to note that a pyonephrosis followed the spontaneous closing of the ectopic opening.

Knoepfelmacher reports an autopsy on a child of 4 who died from a condition diagnosed as an extraperitoneal abscess. The upper, greatly dilated portion of the ureter was filled with pus, while the lower segment of the ureter was contracted.

Kolisko reports an autopsy on a woman 21 years old who died from causes not in any way connected with the malformation. No symptoms referable to the kidney condition had been noted in her life. The right supernumerary ureter entered the bladder wall with the normal ureter but instead of opening into the bladder cavity passed down in the vesicle wall, as a thin walled sac, to open into the urethra almost at the external meatus. The escape of urine from the ectopic opening was controlled by the sphincteric action of the bladder outlet.

Linck reports a discharge of pus from the vagina with later pus from the rectum, evidently the result of an inflammatory perforation.

Mueller, quoting Stolz, reports a girl of 8 who subsequent to a fall developed a tumor of the left renal region, pressure on which caused pus to flow from the urethra.

The patient of Samuels, Kearns, and Sachs, a woman of 29 years, had spasm and rigidity of the entire right rectus and tenderness in the right flank and right lower abdomen but no tenderness in the costovertebral angle.

Pregnancy seems to have exerted some influence in the symptomatology of some patients. Fromme reports the case of a woman of 25 well until 1 year previously when the discharge of purulent urine in the vagina began after a normal delivery. Urination was otherwise normal. J. P. Hartmann reports a woman of 49 incontinent for 24 years since her third normal labor. Previous to that, she had been incontinent only when running or on other exertion. Hayward's case was incontinent from infancy, but the symptoms became much worse after the birth of a child and were always aggravated by coughing or other exertion. Jaffe reports a woman of 22 with typical incontinence for 8 months following her last confinement, pain in the left lower abdomen and tenderness in the left adnexa. Judd reports a patient 48 years old with characteristic incontinence until at the age of 18 the ectopic ureter was implanted into the bladder with complete relief (reported by Maxson). Patient remained well after this for several years until about the middle of her first gestation when the incontinence recurred and

was especially noticeable when she was in the upright position. During the second pregnancy 3 years later there was a greater degree of incontinence.

In these cases in which the incontinence first appeared after childbirth it is apparent that a supernumerary ureter with a blind ending had existed and some trauma incident to the confinement had resulted in rupture of the ureterovaginal septum and the establishment of a permanent fistula.

TREATMENT

The choice of operation necessitates a study of all the factors that may be present in each individual case. The object of surgical intervention is the relief of the patient's symptoms with the minimum interference with kidney function. With a single ureter from the involved kidney the choice rests between a nephrectomy and the diversion of the urine from the involved kidney into the bladder through an implantation into that organ of the ectopic ureter. Here the choice will depend upon the functional activity of the kidney, the amount of infection present, and the presence or absence of sacculation and dilatation in the course of the ureter.

It does not seem that the surgeon would be justified in ligating a single ectopic ureter except under most unusual circumstances. If considerable infection is present or a kidney shows poor functional ability or the ureter is sacculated, dilated, or tortuous, a nephrectomy would be indicated, provided an examination of the other kidney revealed no contraindications.

If the involved kidney shows little or no infection and is capable of good function and the ureter is fairly uniform in caliber, the implantation of the ureter into the bladder may be attempted. However, it is well to remember that the continuous discharge of even a mildly infected urine into the bladder may cause a cystitis intractable to treatment and with symptoms making the patient's condition worse than before relief was attempted.

With a supernumerary ectopic ureter, a wider choice is available. Implantation of the supernumerary ureter involves the same consideration of infection, function of the supernumerary portion of the kidney, and the condition of the supernumerary ureter. If the supernumerary kidney is a separate organ, a true third kidney, removal is clearly indicated with either a total or partial resection of the anomalous ureter. Two such cases are reported—one by Israel and the other by Samuels, Kearns, and Sachs.

When both ureters drain a common pelvis, ligation or ligation and resection of the ectopic duct provides a comparatively easy solution. However, no report of such a case has been found. The closest approach is reported by Juvara who found that the supernumerary ectopic ureter arose from the normal ureter just below the right pelvis. Ligation and resection of the ectopic duct was easily accomplished and resulted in a complete cure.

Resections of the supernumerary portion of the kidney are reported by Furniss, Kakuschkin, and Josephson, the latter presenting a true heminephrectomy in which a resection was made through kidney parenchyma. The feasibility of a heminephrectomy depends to a very considerable extent upon the arrangement of the blood supply to the kidney.

In the author's first case a single vascular pedicle was found to enter the supernumerary portion of the kidney. When this condition exists, resection of the upper portion of the kidney, involving as it does the removal of the entire blood supply, is absolutely not feasible. Successful resection of a portion of the kidney is absolutely dependent on an adequate blood supply to the remaining portion and when doubt exists as to its adequacy, a complete nephrectomy is safer.

Much information as to the size, shape, and position of the normal and supernumerary ureters and pelves and the condition of the respective portions of the kidney can be obtained, before operation, by cystoscopy and pyelography. No idea of the vascular supply and formation, however, is available until the kidney has been exposed, at which time the decision as to which operation is indicated, partial or total nephrectomy, will have to be made.

Kallmann in reporting his cases states that resection of the upper supernumerary section of the kidney could have been performed but

for the reason that large blood vessels leading to the lower segment had been divided before the condition was fully recognized and the nephrectomy had to be completed.

Ligation of ureter. Six ligations are reported. In four the ureter was exposed through an abdominal extraperitoneal approach and in the other two cases through the vagina.

Nové-Josserand reports a case in which a urinary leakage occurred 5 days after a vaginal dissection and ligation of the ectopic ureter, necessitating a secondary nephrectomy. The remaining five cases are reported as successful. Despite these favorable reports, the writer questions the advisability of ligation in any case and is inclined to condemn it in the presence of infection in either the supernumerary or normal section of the kidney.

Anastomosis of pelves. Stammler and Kummel and Graff report similar cases in which, following ligation and resection of the right supernumerary ureter, a connection was successfully established between the two pelves after the manner of an entero-anastomosis. In each instance the left supernumerary ureter was ligated and resected, the ureters and pelves being found too small to permit a plastic joining.

Ureteral anastomosis. Several instances are noted in which consideration was given to the possibility of joining the supernumerary and normal ureters but no report of such an operation has been discovered. When such an operation has been considered, the large size of the supernumerary, as compared with the normal, ureter has apparently caused the operator to decide against attempting an anastomosis. In the author's two cases the disproportionately large supernumerary ureters also seemed to render such a procedure unjustifiable were the other conditions favorable.

If a case presents a large normal and a small supernumerary ureter, an anastomosis of the two ureters might be feasible, but again the presence of infection in the cephalic segment with the possibility of an ensuing cystitis from the infected urine should cause a grave doubt as to the advisability of this operation.

Transurethral operations. Three cases in which operative procedure through the urethra resulted in cures have been reported. Bois introduced a tenatome into the ectopic ureter and guided by a grooved catheter introduced through the urethra cut through into the bladder. The fistula thus established was kept open by passing a sound through it at intervals. At the time of reporting this case, it was planned to close the ectopic opening by freshening and suturing the edges.

Hunner fastened a rubber glove finger on a ureteral catheter and then introduced this into the right ectopic ureter. The glove finger was distended with air pumped through the catheter, the distention causing a marked prominence in the vagina but not in the bladder (viewed through an endoscope) until by finger pressure in the vagina the bladder prominence was brought out. A cautery blade introduced through the endoscope was used to establish a vesico-ureteral opening. This opening was probed from time to time to maintain a permanent fistula. Eighteen months later the patient is reported free of symptoms.

Wollfler (reported by Schwarz) in a girl of 12, by means of an instrument resembling Dupuytren's intestinal clamps, aimed to cause a necrosis of the wall of the bladder and the aberrant ureter. After a careful preliminary dilatation of the urethra, one blade of the instrument was introduced into the bladder, the other blade introduced into the ectopic ureter and the blades locked. On removal 6 days later a thin, necrotic membrane was found between its blades. On digital examination 6 weeks later a communicating orifice 1.5 centimeters long joined the two cavities. Eighteen months later the vesical sphincter was found to be abnormally relaxed and a twisting of the urethra according to the method of Gersuny was performed. After this the patient was able to retain urine up to 6 hours.

Transvesical suprapubic anastomosis. Tauffer through a transvesical suprapubic approach opened the bladder and cut down on a buttoned sound introduced into the aberrant ureter, establishing a connection between the bladder and the supernumerary ureter. No suturing was necessary, so well fixed was the ureter to the bladder wall. This patient made an uncomplicated recovery to cure.

Baum, through the same type of approach, cut through the posterior wall of the bladder into the aberrant ureter and sutured the edges of bladder and ureter. The incontinence was cured, but a vesical calculus formed and was removed some months later.

Implantation. Implantation of the supernumerary or single ureter into the bladder through a vaginal approach is reported in 18 cases, through a suprapubic approach in 8 cases and a subpubic approach in 1 case, making a total of 27 cases thus treated.

In the light of our present-day knowledge there would seem to be no excuse for the subpubic operation. Colzi reports one such operation in a girl of 15 years. A curved incision was made with its convexity upward through the soft parts close to the pubic arch and the vagina and urethra retracted downward. The bladder and ureter were exposed but because of the limited space the lower border of the pubic arch was chiseled off and the ureter was then implanted into the vagina. The patient is reported cured.

Vaginal implantation. Albarran made a vaginal approach and sutured the edges of a wide anastomosis between the bladder and the supernumerary ureter successfully after a previous suprapubic anastomosis had failed.

Baker reports section and implantation of the end of the ureter into the bladder, but 2 months later could not pass a probe into the ureter. Baker also reports the attempt of Dr. Emmett to form a canal by enfolding the vaginal mucosa from a position high in the vagina where the ectopic ureter opened, to a point where a junction could be made with the bladder. This attempt was not successful and this procedure would not be considered.

Benckiser performed a two-stage operation. The first established a connection between the bladder and the supernumerary left ureter, followed 4 weeks later by the closing of the vaginal portion of the fistula. Result, cured.

Davenport reports an implantation of a dilated right ureter followed by a secondary operation to close the persisting fistula. Cured.

Fromme reports an implantation followed by a cure.

Furniss reports an unsuccessful anastomosis between the bladder and ureter, the incontinence reappearing 4 days after the operation. At a second operation the lower end of the ureter was drawn into the bladder by traction upon a suture introduced through the urethra and the ureter was sutured to the bladder wall. The incontinence ceased, but 3 weeks later after the intravenous use of indigo carmine, none could be seen coming from the newly formed ureteral orifice in the bladder nor could the supernumerary ureter be catheterized.

J. P. Hartmann reports a successful implantation in a woman incontinent after the birth of a child.

Joh. Hartman reports a successful implantation of the lower end of a supernumerary ureter into the bladder.

Hohmeier reports a successful implantation of a right supernumerary ureter.

Jaffe reports one successful implantation of a right supernumerary ureter.

Kelly and Burnam report two cases cured by a longitudinal incision through the anterior vaginal wall and the posterior or approximate wall of the supernumerary ureter, followed by another like incision through the anterior wall of the ureter into the bladder with careful approximation of the edges of bladder and ureter, after which the primary incision through the vagina was closed.

McArthur successfully implanted the cut end of a ureter into the bladder after another surgeon at a previous operation had failed to control the incontinence.

Maxson reports a case in which the ureter was cut across and the end drawn into the bladder by traction on a suture introduced through the urethra, the ureter then being fixed to the bladder by sutures. This case is reported cured, but a recurrence of the incontinence several years later after the birth of a child is reported by Judd.

Olshausen reports a case in which the supernumerary ureter was first sutured into the urethra. This operation was followed by fever and pain in the right side. At a second operation the ureter was implanted into the bladder but three additional plastic operations were necessary to cure the incontinence. The patient is reported entirely well 5 years after operation.

Pieri reports the implantation of a right ectopic ureter followed by fever and pain along the course of the ureter. A vaginal incision was made and a large amount of purulent urine released. The ureter was again implanted into the bladder, but a month later a nephrectomy was necessary.

Suprapubic implantations. Reports of 8 cases so treated were found. Albarran through a transverse hypogastric incision exposed the supernumerary ureter and sutured the vesical and ureteral edges. His case was unsuccessful, the incontinence recurring 1 week later.

Christofoletti divided the ureter and ligated the distal end. The proximal end was then implanted into the vertex of the bladder. The patient was cured.

Desnos successfully implanted the proximal end of the divided ureter into the bladder.

Hayward made a suprapubic retroperitoneal exposure and implanted the right supernumerary ureter into the bladder, with a successful result.

Judd, through a right rectus incision and an extraperitoneal approach, found a greatly thickened and dilated ureter and implanted the proximal end into the bladder with the decision to do a nephrectomy later if necessary. Two days later there was considerable pain in the region of the right kidney and pus was found in the urine. Two ureteral catheters were passed to the right pelvis and continuous pelvic lavage instituted. This patient is reported free from symptoms 18 months after operation.

Kuettner implanted the ureter into the bladder in an oblique direction and reports the case cured.

Schaefer successfully implanted a supernumerary ureter into the bladder through a suprapubic extraperitoneal approach.

Westhoff, in a girl of 7, considering the parts too small to permit a successful vaginal approach, used a suprapubic extraperitoneal approach. An ectopic, not supernumerary, ureter (left) was implanted into the bladder and the patient was reported cured 1 year after operation.

Nephrectomy, while the safest and simplest operation from the standpoint of its immediate effect upon the recovery of the patient, necessarily entails a consideration of all the existing factors before its choice as the operation of election. Nevertheless, its performance should cause no hesitation if the general condition of the patient, including the demonstration of a normally functioning opposite kidney warrants it and anatomical and pathological conditions present seem to preclude the success of more conservative measures.

Chute removed an entirely destroyed left kidney. There was complete duplication of the pelvis and ureters and separate arterial supply to each portion of the kidney. Some years later a cystogram showed the remains or stump of the dilated ureter appearing as a diverticulum the size of a small sausage and evidently the source of very foul urine. With the exception of Day's case this is the only report of an operation on a male patient.

Day removed the left kidney which was immensely dilated, sacculated and filled with pus. A portion of the ureter (the lower end of which opened into the posterior urethra) was removed at the same operation through a Gibson's incision. A secondary operation was necessary for the removal of the extreme lower portion of the ureter. The patient was cured. This is the only case found reported in which a complete and accurate pre-operative diagnosis was made in a male.

Successful nephrectomies are reported by Kakuschkin, Kallmann, Linck, Mueller, quoting Stolz and Nemenoff. These, with the author's two cases, make a total of nine primary nephrectomies.

In the only instance in which the presence or absence of infection in the supernumerary portion of the kidney is emphasized Nemenoff reports a case operated on by Professor Schirschow who decided against implantation of the infected ureter into the bladder and resorted to a nephrectomy.

Two cases have come under the writer's personal observation.

A. D., a woman, age 32, married, came under observation early in 1923 referred by Dr. Edgar E. Stewart of Great Neck, Long Island. The family history is negative. Both parents are alive and well. Patient had had typhoid fever when 8 years old. When 3 years old, no urine was voided for a period of 3 days. Further details of this illness are unobtainable beyond the statement from the patient's

mother that after taking some medicine prescribed by a physician the condition cleared up and the patient was as well as ever. She has been married 6 years; has been pregnant twice, each time going to full term without complications. Both deliveries were normal and the children, one 5 years old, the other 3, are living and in very good health. Her menstrual history is negative.

Chief complaint. As far back as she can remember it has been necessary to wear a napkin because of constant leakage of urine, and her mother states that as a child she was never dry. The wetting has been continuous day and night, and as far as the patient has observed not influenced by posture, bodily activity, or any other factor. As a rule the flow has been a gradual drop by drop secretion, the amount of moisture on the napkin depending upon the length of time worn. On rare occasions there has been a marked increase in the quantity of the leakage. No particular cause has ever been noted to explain these unusual fluxes.

The act of urination is always normal and without undue frequency or urgency; a normal desire to urinate occurs at regular intervals; there is no dysuria, and normal relief is experienced after the bladder is emptied. The leakage is independent of, and not influenced by, urination and is just as rapid immediately after urination as at any other time.

Physical examination. Patient is a well developed and well nourished young woman of strong physique. Nothing of pathological importance was discovered in the routine examination of the chest and abdomen. The pelvis is negative. The left side of the external meatus is œdematous but not congested. The external genitals are moist and when dried quickly become moist again, the dampness first appearing near the urinary meatus. A catheter can be passed into the bladder readily and clear urine is obtained. While the catheter remains in the urethra the genitals are dry but moisture appears again immediately after withdrawal of the catheter. Visual examination of the vagina and cervix is negative except that the patient remains entirely dry while the speculum is in place but becomes wet immediately after the speculum is withdrawn. As it afterward developed, the supernumerary ureter is situated to the left of the urethra, so that pressure from either a catheter in the urethra or a speculum in the vagina is sufficient to prevent the escape of fluid from the ectopic opening. With good exposure and light a small drop of fluid can be seen to form in the œdematous mucosa contiguous to the left lip of the meatus, and at this point a No. 5 F. ureteral catheter can be introduced into a small opening. The catheter passes its entire length, 50 centimeters. Turbid fluid immediately flows through the catheter and with an aspiration syringe 30 cubic centimeters of the fluid is obtained, this fluid becoming progressively more turbid as the aspiration progresses, until at the end it is purulent.

Cystoscopic examination shows a normal bladder with normal right and left ureteral orifices. Each ureter is readily catheterized, the catheters pass up the usual distance and no obstructions are noted. Neither pelvis contains residual urine. The flow of urine from either catheter is intermittent in character and rapid in rate and the urine is clear in gross appearance, in marked contrast to that obtained through the catheter in the ectopic opening.

Salt solution deeply colored with methylene blue was introduced into the bladder while negative pressure was maintained through the third catheter in an attempt to demonstrate a connection between the bladder and the anomalous opening, but none of the dye comes through the catheter. Salt solution deeply stained with mercurochrome was then injected through the ureteral catheters into each pelvis and these catheters withdrawn. Again no color can be found in the fluid coming from the remaining catheter.

At this stage of the examination it is possible to diagnose a supernumerary ectopic ureter coming either from a separate third kidney or from a kidney with two separate and non-communicating pelves.

A roentgenogram, Figure 1, shows that the catheter in the supernumerary ureter lies curled up in a circle of small radius just above the upper border of the symphysis, the entire length of the catheter having curled up in this area. A roentgenogram made after injecting a 12.5 per cent solution of sodium iodide into the supernumerary ureter shows an enormously dilated and sacculated ureter on the left side (Fig. 3). The ureter appears to end in a globular sacculation, the upper portion of which reaches to about the level of the upper border of the sacrum. Beyond this point the injected fluid does not ascend. The strictured portion of the ureter discovered after operation explains the failure of the opaque fluid to reach a higher level.

The left normal pelvis is very small with but two calyces. The left ureter is also very small but normal in position in its course from the pelvis to the bladder.

A pyelo-ureterogram shows the right pelvis to be in normal position and of normal size and outline and the right ureter of normal size and position throughout its course from the pelvis to the bladder (Fig. 2).

Urinalysis by Dr. Cyrus W. Field

	Per cent		
	Right	Left	Supernumerary
Ammonia	.018	.016	.030
Sodium chloride	.710	.650	.390
Urea	.840	.780	.430
Uric Acid	.026	.024	.015
Creatinin	.042	.040	.020
Blood	None	None	None
Pus	None	None	Very much
Culture	Sterile	Sterile	Bac. coli communis

Diagnosis. Supernumerary ureter opening near external urinary meatus. The supernumerary kidney or cephalic portion of the left kidney shows marked infection and poor functional activity.

Choice of operation. Implantation of the supernumerary ureter into the bladder was considered

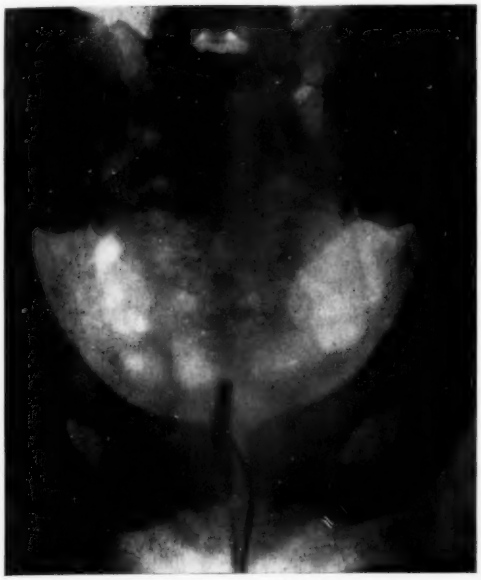

Fig. 1. Opaque catheter introduced through the ectopic opening alongside of the external meatus, coiled up in dilated left supernumerary ureter behind and above the symphysis pubes.

Fig. 2. Normal right pelvis, lower pelvis of the left kidney and lower portion of the supernumerary left ureter.

inadvisable because of the infection present in the supernumerary kidney. Ligation of the ureter was discarded for the same reason. Exploration of the kidney was decided upon with the hope of finding a condition that would permit a heminephrectomy. The alternative was a nephrectomy.

Operation was done February 7, 1923. Patient was placed on her right side with a kidney bag under the flank. Incision was made from in front of the left anterior superior illiac spine upward and backward to end above the twelfth rib 3 inches from midline of back, through skin, fascia, and muscles, exposing the perirenal space. The kidney capsule was opened and the kidney was freed without difficulty and delivered into the wound for examination.

Two ureters, each with a separate pelvis, were found to come from a single kidney. A very small ureter, approximately the size of an eighteen gauge hypodermic needle drained the lower pelvis. This ureter was situated behind and at the left or outer side of a very large supernumerary ureter draining the cephalic portion of the kidney. The vascular pedicle entered the kidney close to the upper pelvis and there was an entire absence of any vascular pedicle directly to the lower portion of the kidney. It was readily apparent that the distribution of the blood vessels precluded a heminephrectomy and the operation was finished as a nephrectomy. Without any particular technical difficulty, the kidney was removed, the operation differing from the usual nephrectomy only in the necessity of removing two ureters. The smaller lower ureter was divided between ligatures and the lower end dropped into the wound. The larger ureter was freed by blunt dissection down as far as could be reached, there divided between ligatures and the wound closed in the usual manner, using chromic gut sutures for the muscles, silk for the skin, and silkworm-gut tension sutures. A wrapped gauze drain was inserted for drainage.

The patient was then turned on her back and an incision corresponding to an intramuscular appendectomy approach was made down to the peritoneum on the left side. This was pushed forward and upward, exposing the supernumerary ureter, which was readily recognized. The ureter was freed until the upper end was brought out of the wound, after which the dissection was continued downward to just above the upper border of the symphysis. Here this ureter was ligated and divided with the cautery. A wrapped gauze drain was inserted down to the stump of the ureter and the wound closed.

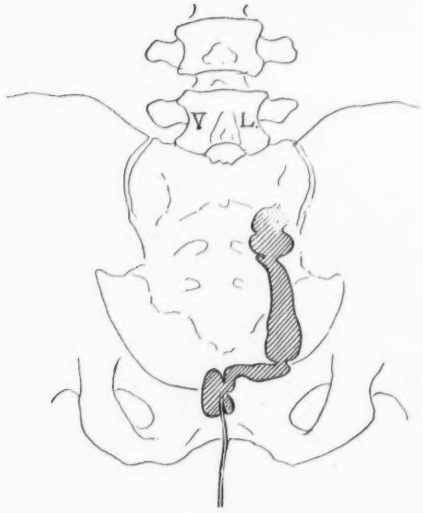

Fig. 3. Tracing made from roentgenogram showing sacculated and dilated supernumerary left ureter, the injected fluid reaching only part way up the ureter.

The kidney measures 11.5 by 4 by 7 centimeters and has attached to it two small ureters, one at the caudal extremity and the other at the cephalic end (Fig. 4). The external markings of the kidney are normal except for a small cyst of the lower pole.

Fig. 4. Roentgenogram taken after removal of the kidney, showing the normal lower pelvis with a very small ureter and the small upper supernumerary pelvis with the greatly dilated ureter.

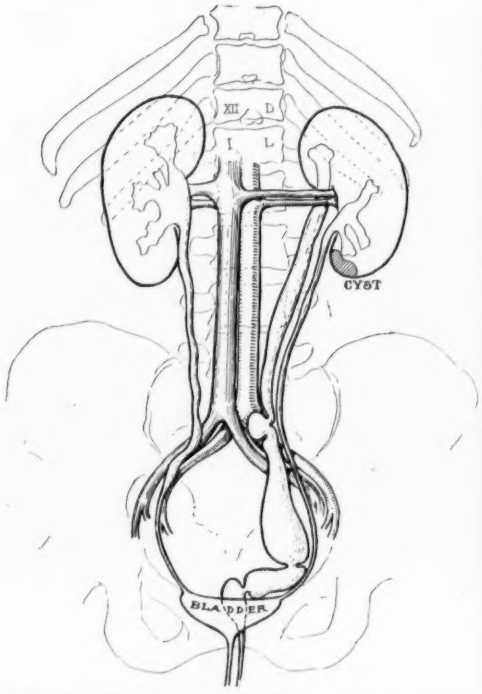

Fig. 6. Diagrammatic reproduction of structures as found by examination and at operation, showing supernumerary and normal kidney pelves and ureters.

The kidney has two pelves. The cephalic pelvis is small and situated on the inner upper aspect of the superior pole. The ureter from this pelvis is more than 1.5 centimeters in diameter at the upper end and is alternately sacculated and constricted throughout its length. A small stricture at about its

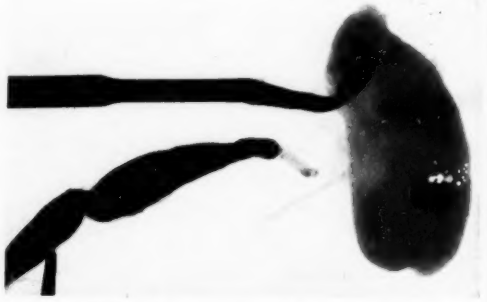

Fig. 5. Dilated supernumerary ureter with constriction at about its middle. Because of this constriction, the sodium iodide solution failed to pass upward beyond the level of the upper border of the sacrum.

Fig. 7. One catheter introduced through the ectopic opening lies coiled above the symphysis. The other catheter introduced through the bladder is in the left ureter.

middle explains why the sodium iodide solution injected in making the pyelogram failed to pass upward beyond the level of the upper border of the sacrum (Fig. 5). The lower pelvis is normal in size but its ureter is very small, the lumen admitting with difficulty a No. 18 gauge needle. A single vascular pedicle enters the kidney close to the cephalic pelvis. There is no line of demarcation, showing the attachment of the supernumerary portion to the normal kidney.

Microscopical examination by Dr. William Crawford White. Sections show a congestion within the glomeruli and degeneration of the tubules almost resembling cloudy swelling. Some areas are free but there are many sections in which the tubules take the stain very poorly and the lumen is packed with a granular detritus. There are areas of hyalinization in the cortex. Section of the accessory ureter shows a great thickening of the wall with the deposit of some round cells, and with a large deposit of detritus in the lumen.

Pathological diagnosis. Chronic nephritis, one normal ureter, chronic inflammation of accessory ureter.

CASE 2. D. T. is a 14 year old school girl who has always been a normal, active, and healthy child in every way except for urinary incontinence. Her mother reports that she has never been dry from the time of her birth, although at the usual age she exhibited normal control of stool and urine. Urination

Fig. 8. Roentgenogram showing the supernumerary right pelvis, the upper and lower sections of the supernumerary ureter and the normal right pelvis filled with a solution of sodium iodide and an opaque catheter in the normal right ureter.

is voluntary, at regular intervals in response to the usual demand, and is followed by the usual relief. A continuous leakage goes on without any relation to urination and is not influenced in any way by the latter. The history is that typical of an ectopic opening of the ureter.

Physical examination is entirely negative except for cystoscopic and radiographic findings.

Cystoscopic examination. Bladder tolerance, bladder capacity, the bladder mucosa, trigone, and ureteral orifices are all normal. Catheters pass to either pelvis readily, no obstruction being noted. The flow of urine begins from each side immediately and is normally intermittent in character and rapid in rate. The urine is clear in gross appearance. There is no residual urine in either pelvis. Pyelograms of either side show the pelves to be of normal position, shape, and size. Externally just to the right of the external urinary meatus there is a very small opening from

Fig. 9. Reproduction from roentgenogram of supernumerary and normal right pelves and ureters.

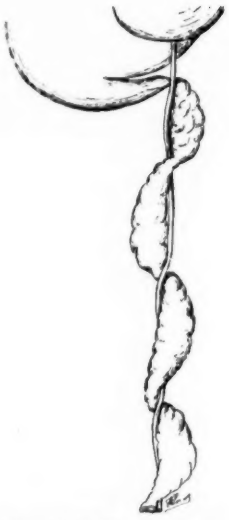

Fig. 10. The alternately dilated and constricted supernumerary ureter winding about the normal ureter. (From Mesley and Veau.)

which fluid escapes drop by drop. After considerable difficulty, a small ureteral catheter was passed into this opening and a large amount of light colored, slightly turbid urine was aspirated. The catheterization of this supernumerary ureter caused very considerable pain to the patient, the only pain complained of during the examinations. During the catheterization of the accessory ureter, colored fluid was successively injected into the bladder, left kidney, and right kidney without any of the color-appearing in the urine from the extra ureter (Fig. 7).

The ureterogram of the supernumerary ureter shows a large, dilated ureter extending from behind the symphysis up the right side to the level of the upper border of the sacrum, where the outline is lost to reappear at the level of the lower border of the third lumbar vertebra, then extending upward as a funnel shaped tube, large above (inside and above the normal right ureter and pelvis) evidently opening into the upper part of the right kidney (Fig. 8). There are none of the usual markings of calyces.

Urinalysis by Dr. Cyrus W. Field

	Left	Right	Extraureter
Color	Lemon	Lemon	Lemon
Sediment	Slight	Slight	Slight
Reaction	Alkaline	Neutral	19 N/10 acid
Ammonia	0.0061%	0.0024%	0.0034%
Urea	.340	.296	.221
Uric Acid	.009	.005	.004
Creatinin	.013	.0092	.0073
Na Cl	.21	.23	.57
Albumen	None	None	Very faint trace
Pus	None	None	Few
Casts	None	None	None
Epithelial Cells	Few	Few	Few
Culture	Sterile	Sterile	40 colonies B. coli per c.cm. urine

Operation. The usual kidney incision was made through the skin, fascia, and muscles, exposing the right kidney. The kidney was freed with finger dissection, delivered, and the lower ureter readily identified. The supernumerary ureter attached to the upper pole of the kidney was identified as a very large tube and the vascular pedicle was isolated and found to enter the kidney at a point about midway between the ureters. There was no line of demarcation marking the kidney off into separate portions and it was decided that a total nephrectomy would be safer under the circumstances than an attempt to do a heminephrectomy. The lower ureter was divided between ligatures and the distal end dropped back into the wound. The larger ureter was then freed down as far as possible and cut between ligatures. The vascular pedicle was ligated with No. 2 chromic catgut ligatures. No clamps were necessary as the exposure was very good and it was possible to ligate the vessels separately. The kidney was then removed. The incision was closed in the usual way. A rubber tissue drain was placed down to the stump of the pedicle.

The patient was then turned on her back and an intramuscular incision made, corresponding to that used for an appendectomy, the peritoneum pushed forward, and the two ureters readily identified—the supernumerary ureter being posterior to the normal one. The supernumerary ureter was then

freed upward until the cut end could be brought out of the wound, then downward to the posterior aspect of the symphysis where it was cut between ligatures. Rubber tissue drain was inserted down to this point.

Pathological report. Specimen consists of a kidney measuring 12.5 by 6.5 by 4 centimeters. The greater part of the kidney is of normal appearance but a separate and extra ureter enters the upper pole of the kidney and there opens into the small pelvis which drains the parenchyma of the extreme upper end. There is no sharp dividing line in the gross between the kidney tissues drained by the two ureters. The kidney parenchyma appears quite normal in the gross except that the parenchyma over the supernumerary pelvis is thinned out. The mucosa of the normal pelvis shows many small hæmorrhages.

Microscopic examination by Dr. William Crawford White. Sections were cut through the kidney parenchyma draining into the normal and accessory pelvis. There is no marked difference in the kidney tissue in these two areas. Some of the convoluted and straight tubules were moderately dilated and lined by compressed more or less degenerated cells, but on the whole the epithelial elements were well preserved. The glomeruli were normal; only occasionally was a dilated glomerular space with a shrunken vascular loop encountered. There was no inflammatory reaction present though in the immediate neighborhood of the minor calyces and the accessory pelvis many of the collecting tubes had atrophied and were replaced by connective tissue.

Diagnosis. Mild parenchymatous nephritis in kidney with accessory pelvis and ureter.

A review of the literature has resulted in finding 98 reported cases; these with the two here reported make a total of one hundred in all. These have been arranged in tables according to the type of anomaly as follows:

Table I. Single ureter with ectopic opening.

Table II. Complete unilateral duplication of pelvis and ureter with an ectopic opening of the supernumerary ureter.

Table III. Complete unilateral duplication of pelvis and ureter with ectopic opening of both ureters.

Table IV. Supernumerary kidney, pelvis, and ureter with an ectopic opening.

Table V. Bilateral duplication of pelves and ureters with one ectopic opening only.

Table VI. Bilateral duplication of pelves and ureters with bilateral ectopic openings.

Table VII. Both single ureters having ectopic openings.

It is to be noted that 65 cases have been reported as occurring in females and 35 in the male, a ratio of practically 2 to 1. Of the female cases reported, but nine were found at autopsy; the remainder are reported as operations or examinations, while in the male cases reported 33 are autopsy reports. A diagnosis was made in the living male in only 2 cases.

TABLE I.—SINGLE URETER WITH ECTOPIC OPENING

Reporter	Sex	Age		Remarks
Baker	F	22	Operation	
Baker	F	20	Operation	Operation by T. A. Emmett, Woman's Hospital, New York.
Baker	F	15	Examination	Case taken from the records of the Boston City Hospital.
Bois	M		Autopsy	Horseshoe kidney. The ureter from the left portion dilated and filled with urine, opened at the colliculus seminalis.
Carrieu	M		Autopsy	Left ureter from a horseshoe kidney opened in posterior urethra.
Chuchu	M		Autopsy	Single ureter opened into the prostate.
Colzi	F	15	Operation	Left ureter opened near the meatus.
Davenport	F	29	Operation	Not necessarily a single ureter but details of examination are incomplete.
Day	M		Operation	Supernumerary left ureter opened into prostatic urethra.
Eppinger	M	22	Autopsy	Left ureter opened in the left seminal vesicle and through the ejaculatory duct into the posterior urethra.
Gruber	M		Autopsy	Ureter from right rudimentary kidney opened in the right seminal vesicle.
Hunner	F	56	Operation	Right ureter opened on the right posterior urethral wall.
Judd	F	21	Operation	Right ureter opened on right wall of the urethra.
Madden	F	16	Examination	
Weigert	M	Still-born	Autopsy	Dilated and cystic left ureter ended in the left seminal vesicle and through ejaculatory duct into the posterior urethra.
Westhoff	F	17	Operation	
Winter	F		Operation	Single right ureter opened on the right side of the vestibule.
McArthur	F	11	Operation	Left ureter opened in vagina.
Morris		Child	Autopsy	Both right and left ureters (not supernumerary) opened in urethra. Specimen Guy's Hospital Museum No. 1689.
Nicholich	M	40	Autopsy	Right supernumerary ureter, filled with pus, opened in prostatic urethra.
Pieri	F	16	Operation	Right ureter opened externally in vestibule.
Rott, Th.	M	52	Autopsy	Atrophic right kidney with a sacculated and dilated ureter opening in posterior urethra.
Schwartz	F	12	Operation	Orifice below the meatus. Whether single or supernumerary not noted.
Von Massari	F	4	Autopsy	Fused kidney. Left ureter opened in a fold of the vulva.

TABLE II.—COMPLETE UNILATERAL DUPLICATION WITH ECTOPIC OPENING OF THE SUPERNUMERARY URETER

Reporter	Sex	Age		Remarks
Albarran	F	20	Operation	Ectopic opening (side not noted) on anterior vaginal wall.
Albarran	F		Operation	Supernumerary ureter opened in vulva.
Baumm	F	18	Operation	Right supernumerary ectopic opening near the external meatus.
Benckiser	F	28	Operation	
Christofoletti	F	15	Operation	Left ectopic and supernumerary ureter opened in the vaginal vestibule.
Chute	M	42	Operation	Supernumerary right ureter opened in the prostatic urethra.
Civiale	M		Autopsy	Supernumerary ureter (side not mentioned) opening in the posterior urethra.
Desnos	F	17	Operation	Ectopic opening in the vagina.
Dickenson	M	57	Autopsy	The ectopic opening in the posterior urethra of the left supernumerary ureter contained a small calculus.
Englisch	M		Autopsy	Supernumerary ureter opens in posterior urethra.
Erlach	F		Autopsy	Right supernumerary ureter opened in the urethra.
Fromme	F		Operation	Supernumerary ureter opened in a urethral diverticulum.
Furniss	F	20	Operation	Left supernumerary ureter opened near the meatus.
Furniss	F	38	Operation	The location of the extra vesicle opening in this instance was not discerned either before or after operation.
Hartmann, J. P.	F	49	Operation	Ectopic opening of left supernumerary ureter near the meatus.
Hartmann, Joh.	F	33	Operation	Right supernumerary ureter opened just posterior to the meatus.
Hayward	F	34	Operation	Right supernumerary ureter opened in the vaginal vestibule.
Hoffman, C. E. E.	M	42	Autopsy	Left supernumerary ureter opens into the posterior urethra through the left ejaculatory duct.
Hoffman, C. E. E.	M	42	Autopsy	Right supernumerary ureter joined the right vas deferens to open in the posterior urethra.
Hohmeier	F	15	Operation	Right supernumerary ureter opened just above the meatus.
Jaffe	F	22	Operation	Left supernumerary ureter opened in urethra near the meatus.
Josephson	F	18	Operation	Left supernumerary ureter opened on the anterior vaginal wall.
Josso	F	3 wks	Autopsy	The supernumerary right ureter opened in the urethra very close to the external meatus.
Judd	F	48	Operation	
Juvara	F	40	Operation	The right supernumerary ureter opened at the right of the meatus. Its upper end joined the normal ureter at an acute angle immediately below the pelvis of the right kidney.

TABLE II.—Continued

Reporter	Sex	Age		Remarks
Kakuschkin	F	32	Operation	Right supernumerary ureter opened posterior to the external meatus.
Kakuschkin	F	32	Operation	
Kallman	F	21	Operation	Right supernumerary ureter symptoms cured by operation. The ectopic opening was never recognized.
Kelly and Burnam	F	15	Operation	Right supernumerary ureter opened near the meatus.
Kelly and Burnam	F	30	Operation	
Kolisko	F	21	Autopsy	Right supernumerary ureter opened in the urethra.
Kuettner	F	15	Operation	Right supernumerary ureter opened near the external meatus.
Lauth	M		Autopsy	Supernumerary ureter opens in posterior urethra.
Lechler	F	Infant	Autopsy	The left supernumerary ureter ended in a saccular dilatation between the bladder and vagina. The ectopic opening was not discovered but urine had been seen escaping from the surface of the cyst.
Linck	F	7	Operation	The right supernumerary ureter was filled with pus. The ectopic opening was not discovered but a discharge of pus from the vagina had been noted before operation.
Maxson	F	22	Operation	Right supernumerary ureter opened in the urethra near the external meatus.
Nemenoff	F	39	Operation	Ectopic opening near the urethral orifice on the vulva—side not noted.
Nicholich	M	40	Autopsy	Supernumerary right ureter opened into prostatic urethra.
Nové-Josserand	F	14	Operation	Supernumerary right ureter opened in the urethra.
Olshausen	F	15	Operation	Supernumerary right ureter opened on the vulva near the external meatus.
Palma	M	6	Autopsy	Supernumerary left ureter entered the left seminal vesicle and through the left vas deferens into the posterior urethra.
Reliquet	M	45	Autopsy	Right supernumerary ureter opened in the posterior urethra.
Remy	M	6	Autopsy	Right supernumerary ureter opened in the right lobe of the prostate.
Robinson, B.	M	63	Autopsy	Right supernumerary ureter opened into urethra.
Ries	F	19	Operation	Left supernumerary ureter opens posterior to the meatus.
Schaefer	F	18	Operation	Right supernumerary ureter. Location of ectopic opening not noted
Stolz	F	8	Operation	Left supernumerary ureter opened into the urethra.
Tauffer	F	14	Operation	Supernumerary left ureter opened into the upper third of the urethra.

TABLE II.—Continued

Reporter	Sex	Age		Remarks
Thumin	F	23	Operation	Right supernumerary ureter ended in a blind sac. The ectopic opening was not found. Incontinence had existed and was cured by removal of supernumerary ureter.
Tovey	F		Operation	Supernumerary ureter opened in vagina.
Wedensky	M	28	Autopsy	Right supernumerary ureter opened in the posterior urethra.
Wertheim	F	18	Operation	
Wulff	F	14	Examination	Supernumerary ureter (side not noted) opened at the labium minora.
Wollfler	F	12	Operation	

TABLE III.—COMPLETE UNILATERAL DUPLICATION; BOTH URETERS ECTOPIC OPENINGS

Reporter	Sex	Age		Remarks
Obici	M	55	Autopsy	Both right ureters opened in the posterior urethra.
Rech	M	69	Autopsy	Both left ureters opened into a dilated left seminal vesicle.

TABLE IV.—SUPERNUMERARY KIDNEYS, URETERS, AND PELVES

Reporter	Sex	Age		Remarks
Samuels, Kearns and Sachs	F	29	Operation	Complete unilateral duplication of ureters, pelves and kidneys. A supernumerary right kidney in a separate sac above the kidney. Supernumerary ectopic orifice in the vagina.
Israe	F	32	Operation	Remains of a separate kidney degenerated into a pus sac. Ureter opened on the vaginal wall.

TABLE V.—BILATERAL DUPLICATION OF PELVES AND URETERS: ONE ECTOPIC OPENING

Reporter	Sex	Age		Remarks
Alsberg	F	18	Operation	Right supernumerary ureter opened in vagina. Death from sepsis following attempt to extirpate the ureter.
Connitzer	F		Autopsy	Right supernumerary ureter opened into the vagina. Patient died from a purulent pyelitis.
Handl	M	29	Autopsy	Right supernumerary ureter opened in posterior urethra.
Huntington	M	48	Autopsy	The right supernumerary ureter opened in common with the right ejaculatory duct in the floor of the prostatic urethra.
Knoepfelmacher	F	4	Autopsy	The right supernumerary ureter, filled with pus, opened in vagina.

TABLE V.—Continued

Reporter	Sex	Age		Remarks
Madelung	F	14	Examination	Left supernumerary ureter opened into the vagina.
Mesley and Veau	M		Autopsy	Left supernumerary ureter opened into prostatic urethra after passing through the prostate.
Mayer	F	14	Autopsy	Right supernumerary ureter opened into the urethra.
Peacock	M	9 mos.	Autopsy	Right supernumerary ureter opened in the prostatic urethra. Left supernumerary ureter ended in blind sac.
Rumpel	F		Autopsy	Right supernumerary ureter opened at the side of the external urinary meatus.
Tangl	M	28	Autopsy	Left supernumerary ureter opened in the posterior urethra.
Walter	M	39	Autopsy	The supernumerary right ureter opened in the posterior urethra.
Weigert	M		Autopsy	Right supernumerary ureter opened in posterior urethra. Two left ureters joined 15 cm. below kidney.
Zalusky	M		Autopsy	Right supernumerary ureter opened in posterior urethra.

TABLE VI.—COMPLETE BILATERAL DUPLICATION OF PELVES AND URETERS WITH BILATERAL ECTOPIC OPENINGS

Reporter	Sex	Age		Remarks
Stammler	F	15	Operation	Bilateral complete duplication with two ectopic openings. Right ectopic ureter opened into the end of the urethra. The left opened on the left side of the meatus.
Kummel and Graff	F	15	Operation	

TABLE VII.—BOTH SINGLE URETERS HAVING ECTOPIC OPENINGS

Reporter	Sex			Remarks
Binninger	M		Autopsy	Both single ureters opened into the posterior urethra. Bladder was absent.

TABLE VIII.—TABULATION OF REPORTED CASES FOUND IN LITERATURE[1]

	Operation	Female Autopsy	Examination	Operation	Male Autopsy	Total
Table I	11	1	2	1	9	24
Table II	37	4	1	1	13	55
Table III	0	0	0	0	0	2
Table IV	2	0	0	0	0	2
Table V	1	4	1	0	8	14
Table VI	2	0	0	0	0	2
Table VII	0	0	0	0	1	1
Totals	53	9	4	2	33	100

[1] The author's two cases are included in this table.

BIBLIOGRAPHY

ALBARRAN. Uretère surnuméraire ouvert dans la vulva et dans le vagin. Gaz. d. hôp., 1897, lxx, 743.

Idem. Quoted by Kelly and Burnam. Original contribution not available.

ALSBERG. Reported in discussion of Wolfler's case. Zentralbl. f. Chir., 22, 118, 1895, xxii, 118.

BAKER, W. H. Malpositions of the ureters. New York M. J., 1878, xxviii, 575.

BAUMM. Ein Fall von drei Harnleiten. Arch. f. Gynaek., 1892, xlii, 329.

BENCKISER, A. Ueber abnorm ausmuendende Ureteren und deren chirurgische Behandlung. Ztschr. f. Geburtsh. u. Gynaek., 1899, xli, 413.

BINNINGER. Quoted by Foerster in Human Deformities. Jena: 1865, p. 127; ibid., Day, R. V.

BOIS. Anomalie de l'uretere chez la femme. Bull. et mém. Soc. de chir. de Par., 1893, xix, 371.

CARRIEU. Anatomical specimen presented at Soc. d. méd. et de chir. prat. de Montpellier. Union méd., 1887, xliv, 728.

CHAPUT. Quoting Albarran. Bull. et mém. Soc. de chir. de Par., 1897, xxiii, 487.

CHRISTOFOLLETTI, R. Beitrag zur Klinik der ueberzaehligen abnormmuenden Ureteren. Wien. klin. Wchnschr., 1910, xliii, 1511.

CHUCHU. Quoted by Secheyron. Arch. de Tocol., 1889, xvi, 254. Original article in Compt. rend. Soc. de Biol., 1873, p. 79. Not available.

CHUTE, A. L. A suppurating supernumerary ureter opening into the prostatic urethra. Boston M. & S. J., 1907, clviii, 385.

CIVIALE. Malades des organs genito-urinaries. 1843, vol. ii, 355.

COLZI. Contributo allo studio delle anomalie di sbocco degli ureteri in vescica. Sperimentale, 1895, xlix, 37.

CONNITZER. Fall von deiderseitiger Verdoppeldung des Ureteren. Zentralbl. f. Gynaek., 1895, xix, 266.

DAVENPORT, F. H. A case of incontinence of urine due to malposition of the ureter. Tr. Am. Gynec. Soc., 1890, xv, 343.

DAY, R. V. Ectopic opening of the ureter in the male; with report of a case. J. Urol., 1924, xi, 239.

DESNOS, F. Uretère surnuméraire ouvert dans le vagin, urétéro néocystomie, guerison. Ann. d. mal. d. org. génito-urin., 1907, ii, 1855.

DICKENSON. Kidney with Two Ureters. Tr. Path. Soc. London, xlv, 126.

ENGLISCH. See Day.

EPPINGER. Ueber Agenesie der Nieren. Prag. med. Wchnschr., 1879, xxxvi, 353; also Kleb's Beitr. z. path. Anat., Prague, 1880, ii, 118; also Friedland Prag. med. Wchnschr., 1895, xx, 146.

ERLACH, V. Reported at meeting of Vienna Obstetrical-Gynecological Society, Jan. 8, 1889. Wien. med. Wchnschr., 1889, xiv, 517.

FROMME. Ueberzaehliger Ureter. Ztschr. f. Geburtsh. u. Gynaek., 1913–14, lxxv, 758.

FURNISS, H. D. Supernumerary ureters with extravesical openings. Surg., Gynec. & Obst., 1914, xviii, 584; also J. Urol., 1914, viii, 495.

GOTTSTEIN, G. Fall von ueberzahligen aberrirende Ureter bei nem Lahre alten Maedchen. Allg. med. Centr-Ztg., 1909, xxxv, 487.

GRUBER. Anatomische Notizen. Arch. f. path. Anat., etc., 1876, lxviii, 272.

HANDL, A. Ueber zwei seltene Missbildungen des Harn-Apparates. Frankf. Ztschr. f. Path., 1910, v, 149.

HARTMANN, J. P. Ueber die extravesikale Ausmuendung der Ureteren bei Frauen. Ztschr. f. Gynaek. Urol., 1914, iv, 69.

HARTMANN, JOHANNES. Zur Kasuistik und operativen Behandlung ueberzaehliger aberranter Ureteren. Ztschr. f. Urol., 1913, vii, 429.

HAYWARD, W. G. Supernumerary ureter with abnormal orifice; report of case. J. Am. M. Ass., 1922, lxxix, 965.

HELLER. Quoting Walter. Deutsch. Arch. f. klin. Med., 1869, v, 269.

HOFFMAN, C. E. E. Zwei Falle von Umwandlung der Samenblasen in Harnleiter. Arch. d. Heilk., 1872, xiii, 532.

HOHMEIER. Ueber einen vaginal ausmuendenden ueberzaehligen Ureter und dessen operative Behandlung. Ztschr. f. Geburtsh. u. Gynaek., 1904, lvii, 537.

HUNNER, G. Modern Urology (Cabot). Philadelphia: Lea & Febiger, 1918, ii, 251.

HUNTINGTON, GEORGE. The genetic interpretation and surgical significance of some variations of the genito-urinary tract. Harvey Lectures, 1906–7. Series 2, J. B. Lippincott Co. Quoted by Johnson, Surgical Diagnosis, New York. D. Appleton & Co., ii, 355.

ISRAEL, I. Diagnose und Operation einer ueberzaehligen pyonephrotischen Niere. Berl. klin. Wchnschr., 1918, xlv, 1081.

JAFFE. Zur Klinik urethral, muendender Ureteren. Inaugural Dissertation, Berlin, 1914.

JOSEPHSON, C. D. Ein Fall von Ausmuendung eines ueberzaehligen Ureters in die Vulva durch Nieren resektion geheilt. Zentralbl. f. Gynaek., 1909, xxiv, 836.

JOSSO. Anomalie non décrite de l'urètere. Gaz. méd. de Nantes, 1884, ii, 123.

JUDD, E. S., Supernumerary and single ureters opening extravesically. Surg., Gynec. & Obst., 1918, xxvii, 13.

JUVARA, M. E. Uretère droit double, l'uretère supplémentaire s'abouchant á la vulve, á droit de l'orifice urétral. Bull. et mém Soc. de chir. de Par., 1913, xxxix, 100.

KAKUSCHKIN, N. M. Supernumerary ureter in a woman; certain peculiarities of its clinical course; diagnosis and treatment in a given case. Russk. Vrach., 1912, xxxvii, 1471.

KALLMANN, D. Ein Fall von Pyonephrose durch Ureter-Verschlufs bei zweiteiliger Niere; ein Beitrag zur Klinik der ueberzaehligen Ureteren. Arch. f. klin. Chir., 1923, cxxvii, 458.

KELLY, H. A., and BURNAM, C. F. Diseases of the Kidneys, Ureters, and Bladder. New York: Appleton & Co., 1922, ii.

KNOEPFELMACHER. Nieren-Ureteranomalie; Beiderseitiger Ureter duplex. Wien. klin. Wchnschr., 1902, xi, 297.

KOLISKO, A. Beitrag zur pathologischen Anatomie der Ureteren. Wien. klin. Wchnschr., 1889, xlviii, 917.

KUMMEL, H., and GRAFF, H. Garri-Kuettner Lexer, Handbuch der Chirurgie. 5th ed., vol. iv, 385.

KUETTNER. Ueberzaehligen vestibulaerer Ureter. Implantation in die Blase. Berl. klin. Wchnschr., 1910, iii, 120.

LAUTH, A. Tr. Acad. méd., Par., 1843, Aug. 19; Schmidt's Jahrb., 1835, Apr. 6, p. 377.

LECHLER. Quoted by Boestrum. Beitrage zur pathologischen Anatomie der Nieren. Freiburg: 1884, vol. 1.

LINCK, A. Pyonephrose bei Verdoppelung der rechten Niere. Deutsche Ztschr. f. Chir., 1904, lxxv, 51.

MADDEN, T. M. Urinary incontinence due to malformation. Brit. M. J., 1884, xi, 464.

MADELUNG. Missbildung des uropoietischen Systems; Ueberzaehliger linksseitiger Ureter mit Ausmuendung in die Scheide und divertikelartiger Erweiterung. Deutsche med. Wchnschr., 1908, xii, 535; also Strassburger med. Ztng., 1908, v, 42.

MAXSON, W. H. A case of truant ureter. Med. News, 1896, lxviii, 323.
MAYER, R. Zur Anatomie und Entwieklungsgeschicte der Ureterverdopplung Arch. f. path. Anat., etc., 1907, clxxxvii, 408.
MCARTHUR, L. L. Ureteral fistulæ, their origin and peculiarities, with report of a case. Tr. Illinois M. Soc., 1889, p. 402.
MESLEY, R., and VEAU. Double uretère prostatique hydronephrosé coincident avec deux uretèrs sains s'abouchant dans la vessil. Ann. d. mal. d. org. génito-urin., 1896. xiv, 747.
MORRIS, H. Surgical Diseases of the Kidneys and Ureters. London: Cassell & Co., ii, p. 293.
NEMENOFF, M. J. Radiographies de trois cas d'anomalies des uretères diagnostiqués avant l'opération. J. d'urol. méd. et chir., 1912, i, 439; also Fortschr. a.d. Geb. d. Roentgenstr., 1912, xviii, 2161.
NICHOLICH. Persistance du conduit de Mueller. Comp. rend. de l'assoc. franc. d'urol., 1905, ix, 580.
NOVÉ-JOSSERAND. Un cas d'uretère surnumeraire abouché dans le canal uretèral. Lyon chir., 1922, xix, 602.
OBICI. Le anomalie di sbocco degli ureteri. Bull. d. soc. med. Bologna, 1896, vii, 405.
OLSHAUSEN. Beitrag zur Verirrung der Ureteren und ihrer Behandlung. Ztschr. f. Geburtsch. u. Gynaek., 1899, xli, 423.
PALMA, P. Zur pathologischen Anatomie der Bildungsanomalie im uropoietischen Systems. Prag. med. Wchnschr., 1891, xvi, 32, 33, 367, 379.
PEACOCK, A. H. Multiple ureters with hydronephrosis. J. Am. M. Ass., 1916, lxvi, 1088.
PIERI, G. Malformazione congeniti dell'urerere; uretere sdoppiate sbocco vaginale. Riv. osp., 1913, iii, 493.
RECH, W. Ueber eine eigen thuemliche pornbinierte Missbildung des maennlichen Urogenitalapparates und ihr formale Genese. Ztschr. f. urol. Chir., 1923, xi, 6.
RELIQUET. Persistance du canal de Mueller. Hydronephrose du rein de l'uretère droits. Pyelnonéphrite calcaleuse du rein gauche, très hypertrophié. Progrés. med., 205, 1887, xi–xii, 205.
REMY. Sur l'utricule prostatique et le canal Mueller chez l'homme J. de anat. et de la physiol., 1879, xv, 175.
RIES, E. A case of ectopic ureter. Lancet-Clin., 1915, cxiv, 83.
ROBINSON, BYRON. Prevalence of disease in one of the duplicate ureters. Am. Pract. & News, 1909, xliii, 23.
ROTT, TH. Tr. Physic. Med. Soc., N.S. 13, p. 125. Wuerz 1879, quoted by Day. Original contribution not available.
RUMPEL, G. Congenital anomalies; cystoscopy as adjuvant in surgery, 1910, 5. Translated by P. W. Shedd.
SAMUELS, KEARNS, and SACHS. Supernumerary kidney with ureter opening into vagina. Surg., Gynec. & Obst., 1922, xxxv, 599.
SCHAEFER. Ueberzaehligen aberranter Ureter; Implantation im die Blase durch Laporatomie. Zentralbl. f. Chir., 1917, xxx, 683.
SCHWARTZ, C. Ueber abnorme Ausmuendung der Ureteren und deren chirurgische Behandlung, nebst Bemerkungen ueber die doppelte Harnblase. Beitr. z. klin. Chir., 1896, xv, 159.
SECHEYRON, L. Des abouchements abnormaux de l'uretère, dans le vagin, a la valva. Arch. de Tocol., 1889, xvi, 254.
STAMMLER, A. Zur Kenntniss der aberrierenden ueberzaehligen Ureter. Ztschr. f. urol. Chir., 1913–14; xi, 241.
STOLZ. Quoted by Mueller. Ueber einen Fall von Nicren- und Ureteren Anomalie. Arch. f. Gynaek., 1912, xcv, 687.
TANGL, F. Beitraege zur Kenntnis der Bildungsfehler der Urogenitalorgane. Arch. f. path. Anat., 1889, cxviii, 414.
TAUFFER, W. Beitraege zur Chirurgie der Ureteren und der Niero. Arch. f. Gynaek, 1894, xlvi, 531.
THUMIN, L. Pathogenese, Symptomatologie, und Diagnose der Mundungsanomalien einfacher und ueberzaehliger Ureteren beini Weibe. Berl. klin. Wchnschr., 1905, xlii, 905.
TOVEY, D. N. Tr. New York Acad. Med. in Am. J. Obst., 1915, lxxi, 671.
VON MASSARI, T. V. Ein seltene Anomalie der weiblichen Harn und Geschleichtsorgane. Wien. med. Wchnschr., 1879, xxxiii, 875.
WALTER. Einige Krankheiten der Niere und Harnblase. Berlin: 1800, iv, 14; quoted by Heller, Deutsche Arch. f. klin. Med., 1869, v, 269.
WEDENSKY, K. Ueber einen seltenen Fall von Anomalie der rechten Niero und des Ureteren. Folia urol., 1911, v, 345.
WEIGERT, C. Zwei Faelle von Missbildung einen Ureteren einen Samenblase. Arch. f. path. Anat., etc., 1886, civ, 4; 1878, lxx, 575.
WERTHEIM, E. Beitrag zur Klinik der ueberzaehligen Ureteren beim Weibe. Ztschr. f. Geburtsh. u. Gynaek., 1901, xlv, 293.
WESTHOFF, A. Ueber Diagnose und Therapie abnorme ausgehender vollwertiger Ureteren. Zentralbl. f. Gynaek., 1908, ix, 285.
WINTER, G. Fall von Einmuendung eines Ureter im Vestibulum. Ztschr. f. Geburtsh. u. Gynaek., 1897, xxxvi, 497; also described in Winter's Lehrbuch der gynaekologischen Diagnostik, 1897, p. 497.
WOLLFLER. Ueber abnorme Ausmuendung der Ureteren. Zentralbl. f. Chir., 1895, xxii, 118.
WRANY, A. Verdoppelung eines Ureters, Ausmuendung des ueberzaehligen im der Blasenhals. Oesterr. Jahrb. f. Paediat., Wien, 1870, i, 105.
WULFF. Fall von ueberzaehligen Ureter der Labium minus muendet. Muenchen. med. Wchnschr., 1912, xxv, 1404.
ZALUSKY. Ein Fall von doppelten Harnleitern mit getrennten Ausmunduengen im der Blase. Inaugural dissertation, Griefswald, 1869. Quoted by Englisch, Deutsche. Ztschr. f. Chir., 1878, xi, 11.

In addition to the above the following references may also be of interest.

FRIEDLAND, A. Prag. med. Wchnschr., 1895, xx, 145.
HARPSTER, C. M., BROWN, T. H., and DELCHER, H. A. Abnormalities of the kidney and ureter. J. Urol., 1922, viii, 459.
HERRICK, F. C. Resection of double kidney. Surg., Gynec. & Obst., 1920, xxx, 560.
HRYNTSCHAK, T. Ueber die chirurgische Bedeuntung Doppelbildungen des Nierenbeckens und Harnleiters. Ztschr. f. urol. Chir., 1922, ix, 87.
LICHTENBURG. Die klinische bedeutung der missbildung der Niere, der Nierenbeckens und Harnleiters. Ztschr. f. urol Chir., 1913, i.
MERTZ. Urol and Cutaneous Rev., 1918, xxii, 553; 1920, xxiv, 636.
RUMPEL. Ztschr. f. urol. Chir., 1912, iii, 33.
SACQUÉPÉE, E. Urètere doubleet uretère bifid chez l' homme; étude embryogénique. J. de l'anat. et physiol., Par., 1900. xxxv, 1103.
SIMON and MERTZ. J. Am. M. Ass., 1916, lxvi, 1686.
YOUNG, H. H., and DAVIS, E. G. Double ureter aad kidney with calcareous pyonephrasis of one-half; cure by resection; the embryology and susgery of double kidney and ureter. J. Urol., 1917, i, 17.

EXTRA-UTERINE PREGNANCY AT FULL TERM

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EXTRA-UTERINE pregnancy at full term, with a living child, is, relatively, so rare that I wish to report the following case:

Case. On February 22, 1921, I was called to see Mrs. L. R., age 38, ii para. At this time she was reported to have been in labor for 2 days, apparently at full term. The family history was negative; her childhood and early life had been normal; there was no history of pelvic disease. Her first pregnancy and labor, which had occurred 13 years before, had been normal; the child was still living and in good health. Subsequent menstrual history was normal until May 15, 1920, when last normal menstruation occurred.

Present pregnancy. In June, 1920, she had a profuse discharge, dark in color and with a rather offensive odor, but without pain. There is no history of pain at the time of this first discharge or during the next few weeks. In July or August (she was uncertain as to the exact time) she began to have cramplike pains in the lower abdomen and, on several occasions, felt quite faint. Since the first attacks of pain, she had had no faintness but had suffered, almost constantly, some discomfort in her lower abdomen usually associated with frequent and more or less painful urination.

Physical examination showed a well developed, rather stout woman, with negative findings, except in the abdomen and pelvis. The abdomen was quite distended, smooth, and symmetrical, giving on inspection the appearance one sees in cases of pronounced hydramnios or twin pregnancy at term. On palpation the tense and thick abdominal wall prevented the obtaining of fetal outlines, though what was thought to be a foot was felt on the left side above the level of the umbilicus. In the median line, extending from the symphysis nearly to the umbilicus, and pressed firmly against the abdominal wall, was a tumor mass which could easily be felt, measuring about 7 by 12 centimeters. The fetal heart could be heard, distinctly, on the right side, far back, below the level of the umbilicus.

Vaginal examination showed the presenting part, the head, occupying the pelvis. At first it seemed to be a case in which the head had descended to the pelvic floor after complete dilatation (when called to the case, I had been

Fig. 1. Shows the relations of the child at the time of the first examination.

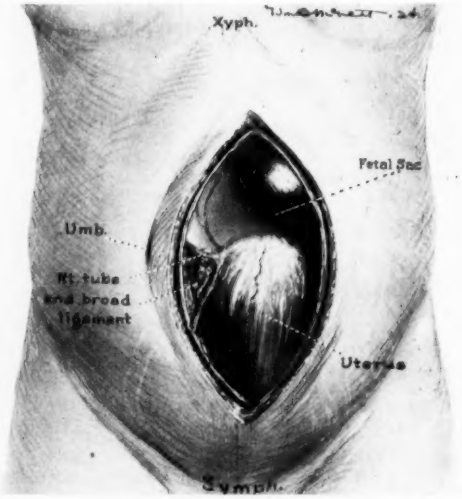

Fig. 2. Shows the abdomen opened with the enlarged uterus, right tube and fetal sac.

Fig. 3. Sagittal section of normal pelvis.

Fig. 4. Shows distention of tube.

told that this was the condition) but further investigation proved this not to be true. Upon attempting to sweep the examining fingers across the head to ascertain its position, it was discovered that the head, while in the pelvis, was not in the vagina. A thin membrane between the examining finger and the head, thought at first to be the fetal membranes, was found to be the septum between the vagina and Douglass' pouch, stretched to an almost incredible thinness. The cervix could not be felt. The head filled the pelvis to the level of the ischial spines (Fig. 1). A diagnosis of extra-uterine pregnancy at full term with a living child was made and an immediate delivery was agreed to. The patient was removed to the Maryland General Hospital and operated upon the same afternoon.

Operation. The abdomen was opened by a left median incision 15 centimeters in length, extending equally above and below the umbilicus. When the abdomen was opened, the tumor described as occupying the median line presented in the lower part of the incision and was found to be the enlarged uterus. Attached to the posterior surface of the uterus and extending laterally to either side was a quadrilateral mass about 12 by 16 centimeters. This was the placenta, which was attached chiefly to the posterior surface of the broad ligaments and the posterior surface of the uterus. There were some small extensions of the placenta to the right side attached to the mesentery and folds of small intestine by light adhesions. Extending from the upper border of the placental mass was the thin fetal sac (Fig. 2). On the right side, the fallopian tube could be seen extending along the upper border. The left tube was not visible, but was apparently incorporated in the mass. The sac was opened and the left foot, which had been felt at the external examination, presented. The child was delivered and seen to be a well developed, normal child. It weighed 8½ pounds. When the sac had been emptied, it was decided that the placental mass could be removed entire, or nearly so, if the uterus were removed at the same time. This was done after tying off several adhesions to the intestines. There was very little bleeding. The incision was closed with two iodoform cigarette drains for drainage.

The patient made a good recovery, the only complication being a slight infection of the incision. I think this was probably due to the drains, which might have been omitted with advantage. She was discharged on the twenty-eighth day entirely well. The baby was also in good condition, except for a stricture of the pylorus, from which it, apparently, entirely recovered. It is now living and well.

The most interesting feature of this case, it seems to me, is the complete descent of the head into the pelvis—indeed, the development of the head must have been entirely in the pelvis. One can hardly account for the

Figs. 5 and 6. Showing how the pelvic development of the head probably acted to prevent the downward growth of placenta.

extreme stretching of the thin partition in front of the child's head, or think it possible, except as the result of a very slow distention (Fig. 1). The uterus had been entirely displaced, no portion of it being in the pelvis. The pain and discomfort reported as being present after the first few weeks largely referred to the bladder, and continuing throughout pregnancy, after the first two months, were no doubt due to the displacement of the bladder and constant pressure by reason of the pelvic position of the head. It requires no great stretch of the imagination to think of the very thin membrane covering the head being mistaken for the bag of waters, with its consequent artificial rupture and the delivery of the child through the vagina.

Another interesting feature was the development of the placenta, which, with the exception of a few small extensions, was an almost exact quadrilateral mass. The very fortunate failure of the lower border to spread over the pelvic floor was due, no doubt, to the pressure applied in an upward direction by the pelvic development of the head.

The decision to operate immediately was due to the fact that the child was evidently fully developed, alive, and in good condition. Statistics show that a large number of children survive the operation, and this makes it important that the interest of the child should not be disregarded. The mortality in operations at term is very little increased over that in operations of a later date. Beck, in a very complete review of this condition, expresses the opinion that allowing the pregnancy to continue, with the resulting death of the child, with the expectation of an easier and safer delivery later, may eventuate in equal difficulties at delivery, an uncertain period of ill health for the mother, and usually shows only a slightly decreased mortality.

Immediate operation in such cases as that reported above, gives the certainty of a living child. This is somewhat offset by the fact that a relatively large percentage of these children are deformed.

This case illustrates the importance of a very careful supervision of pregnant women and a proper regard for a history of irregular bleeding occurring early in pregnancy, especially if accompanied by pain in a case which does not eventuate in miscarriage. Early pelvic examination in such a case could not help but demonstrate the nature of it, as a part of the fetus which could easily have been felt occupied the pelvis after the first few weeks. A pelvic examination at any time before labor must have disclosed the absence of the cervix. In this particular case, the physician was not called until labor had set in, because of the Christian Science proclivities of the parents.

EXPERIMENTAL NEPHROTOMIES

By WILLIAM JAMES CARSON, M.D., Baltimore, Maryland
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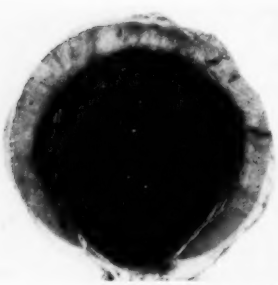
MOORE and Corbett (6, 7) studied experimentally the damage done to the kidney by operation, with a study of the loss of function resulting from such procedure. Some of their conclusions were as follows: (1) An operation on the kidney always destroys a certain amount of kidney substance. (2) The section of the kidney does less harm than the suture necessary to control hæmorrhage. (3) The suture of the capsule alone is not sufficient to control the hæmorrhage. (4) The destruction of the kidney extends far beyond the site of operation. (5) Functional activity of the kidney is somewhat reduced. (6) Histologically, great damage is done to the kidney substance.

Magoun, in 26 experimental nephrotomies on 23 dogs, concluded that, in 14 of his experiments, there was a reduction in the function of the kidney, and that this reduction was in proportion to the amount of kidney tissue destroyed. In these 14 cases, the following complications were observed: uræmia, 7; hæmorrhage, 2; stone formation, 4. Realizing that hæmorrhage is one of the chief complications of nephrotomy, various methods of suturing the kidney were recommended by Moore and Corbett (6, 7), Rehn (1921, 8), Ciminata (1922, 3), Jianu (1922, 4), Magoun (1923, 5), and Beer (1923, 1).

Carson and Goldstein (2) performed 14 nephrotomies on 7 dogs and 7 rabbits, in which no sutures were used, the kidney halves being approximated and held under light pressure until bleeding ceased, without encountering postoperative hæmorrhage, fistula, uræmia, or stone formation. The histological study of nephrotomized kidneys without sutures demonstrated a minimum destruction of kidney tissue. Realizing that nephrotomy without sutures is a radical procedure, and hoping to secure a method which would tend to minimize the element of danger, the author performed the following experiments.

METHOD OF EXPERIMENTATION

The experiments were performed on 18 dogs. In Group 1, 16 dogs were used. In Group 2, 7 dogs used in Group 1 were returned for a third operation and 2 were used upon which a nephrectomy had previously been performed. All of the operations were performed under ether anæsthesia, with sterile technique. The kidneys were delivered through a lumbar incision, and the perirenal fat stripped in all cases. In Group 1 the peritoneum was torn in dogs Nos. 14 and 29, and in Group 2 in dog No. 5; this was closed with catgut before the kidney was sectioned. No clamps were used on the renal vessels in any case. A scalpel was used in all cases for making the incision. In each experiment, the kidney was incised from pole to pole down to the pelvis in the midline. The bleeding surfaces were sponged quickly so that the architecture of the kidney could be observed. The cut surfaces of the kidney were then approximated and held together by light pressure, while interrupted Cushing sutures (No. 0 plain catgut) were introduced into the capsule, without injuring the kidney with the needle. All sutures were tied under slight tension. The time elapsing between the approximation of the kidney halves and the cessation of bleeding was recorded as the bleeding time. After the bleeding ceased, the kidney was watched for 15 minutes before it was replaced into its pocket, and then again observed for from 5 to 10 minutes before the wound was closed. The wound was closed by the layer method with No. 1 chromic catgut. All wounds were closed tightly with cotton and colloidin dressings. All animals recovered from anæsthesia within 15 minutes from the time ether was discontinued. After being returned to their cages, they were watched carefully for blood in the urine. In 24 of the 25 experiments, there was no blood in the urine after the fourth day. They were kept on a liquid diet for 2 or 3 days. The first day after operation, the ani-



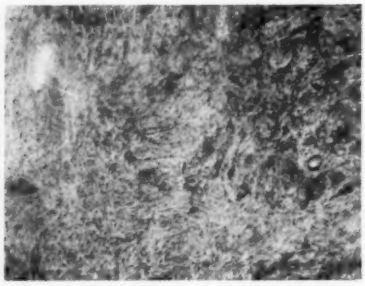


Fig. 1 (left). Right kidney, dog No. 14, 14 days.
Fig. 2. Photomicrograph, right kidney, dog No. 14.

mals were always allowed to run. In Group 1, they were returned for a second operation in 12 instances, the time varying from 4 to 266 days. At this time a nephrectomy was performed on the kidney that was first nephrotomized. Three of the dogs were sacrificed at this time to obtain the other kidney for control. In Group 2, each dog was sacrificed in from 14 to 120 days. All of the kidneys were studied grossly and microscopically.

RESULTS

Gross results in Group 1. In the 16 nephrotomies on dogs with both kidneys, from 3 to 5 sutures were used, average 3.6. The bleeding time varied from 2 to 15 minutes, average 5.4 minutes. The thickness of the blood clot between the kidney halves varied from 2 to 5 millimeters at the time the kidney was returned to its pocket. Gross examination of these kidneys on cross section, show the line of incision up to 15 days to measure 3 to 5 millimeters in width, being yellowish red in color. The striate lines of the kidney in each instance were visible at the edge of the organized blood clot. From 15 to 266 days, the scar line varied from 1 to 5 millimeters in width, being grayish white in color, with the striate lines visible at the edge of this scar line. Four of the 16 dogs died, 1 on the fourth day from peritonitis, 3 from lobular pneumonia on the fifteenth, twenty-ninth, and thirty-first day respectively. Three were sacrificed to obtain the other kidney for control. In no instance was there any complication such as infarct, postoperative hæmorrhage, uræmia, stone formation, or fistula.

Microscopical results in Group 1. In the nephrotomized kidneys up to 10 days, the line of incision is occupied by an organized blood clot, and connective tissue fibers are seen entering the line of incision from the capsule and from the interstitial tissue on each side. The glomeruli and tubules in close proximity to the blood clot are fairly well preserved with well stained nuclei. New formed blood vessels are seen. In the nephrotomized kidney of 15 days, the line of incision is occupied by young connective tissue cells which are well stained, young blood vessels, mononuclear wandering cells, small round cells, a few poorly stained red blood cells, and a moderate amount of hæmosiderin. Nephrotomized kidneys of 24 days and thereafter show the line of incision to be occupied by scar tissue averaging 1.7 millimeters in width, with a thickening of the interstitial tissue due to fibrous connective tissue cells for a distance of 1 millimeter on each side, with no disturbance to the remainder of the kidney.

Gross results in Group 2. In 9 nephrotomies on dogs from which one kidney had previously been removed, from 3 to 5 sutures were used, average 4.2. The bleeding time varied from 2 to 10 minutes, average 4.8 minutes. In Dog 14, there was still blood in the urine; on the fourteenth day the dog had been as active as all others in these experiments, and its general appearance showed it to be in good condition. When sacrificed, the kidney, ureter, and bladder were found to be distended with organized blood clot. The line of incision showed a scar of a yellowish gray color, 2 to 3 millimeters in width (Figure 1).

Fig. 3. Right kidney, dog No. 22, 120 days.

Fig. 4. Photomicrograph, right kidney, dog No. 22.

Fig. 5. Left kidney, dog No. 5, 266 days.

Eight were sacrificed, from 16 to 120 days after the nephrotomy. Gross examination of these 8 kidneys showed the line of incision to be occupied by a scar 1 to 2 millimeters in width and of a yellowish gray color, the striate lines on each side of the scar being distinct in outline. In no instance was there any complication such as infarct, postoperative uræmia, stone formation, or fistula.

Microscopical results in Group 2. In the nephrotomized kidney of 14 days (Figure 2), the line of incision is occupied by scar tissue 1 to 2 millimeters in width. The fibroblasts are seen entering the line of incision from the capsule and from the interstitial tissue on each side. There is a moderate thickening of the interstitial tissue for a distance of 1 millimeter on each side of the scar line. The glomeruli on each side are moderately swollen, with their epithelial and endothelial cells well stained. The tubules in close proximity to the scar are dilated with their epithelial cells well preserved. In several areas the tubules show their epithelial cells to be swollen and finely granular in appearance. An organized blood clot is seen distending the major and minor calyces.

Section from the nephrotomized kidney of 16 days shows the line of incision occupied by a large number of young fibrous connective tissue cells, mononuclear wandering cells, a few polymorphonuclear leucocytes, small round cells, and a few poorly stained red blood cells. New formed blood vessels are seen distended by red blood cells and a few leucocytes. The interstitial tissue on each side for a distance of 1 millimeter is œdematous. Glomerular tufts and tubules are poorly stained for 1 millimeter on each side of the scar line. Beyond this, the kidney shows no changes. Nephrotomized kidneys of 35 days and thereafter, show the line of incision to be occupied by scar tissue averaging 1 millimeter in width, and the interstitial tissue to be thickened for 0.5 to 1 millimeter on each side. New formed blood vessels are seen moderately distended by blood. The tufts and tubules in close proximity to the scar line are well preserved. Beyond this the sections appear the same as the controls.

DISCUSSION

Since the work of Moore and Corbett (6) demonstrated conclusively that sutures in the kidney substance destroy more tissue than the section into it, and in a previous communication we (2) showed that nephrotomy without sutures destroys a minimum amount of kidney substance, it seemed advisable to find a method which would appear rational and yet preserve the maximum amount of kidney tissue; therefore the above experiments were carried out to ascertain the value of interrupted sutures in the capsule.

In the 25 nephrotomies performed with interrupted sutures in the capsule, postoperative hæmorrhage occurred in 1 instance (4 per cent; Dog 14, Chart 2). As the dog was still active on the fourteenth day, and examination of the kidney showed a scar in the line

CHART I.—INTERRUPTED SUTURES IN KIDNEY CAPSULE

Dog No.	Kidney	Date of nephrotomy	Size of kidney at nephrotomy (cm.)	No. of sutures	Bleeding time (minutes)	Date of nephrectomy	Size of kidney at nephrectomy (cm.)	Width of scar (mm.)	Days intervening	Blood in urine (days)	Remarks
29	Right	6-19-24[1]	6.5x3 x2.5	4	2	6-23-24	6.5x4 x3	4	4	4	Died from peritonitis.
34	Right	10-24-24	6.5x4 x3	4	4	11- 3-24	6 x4 x2.8	3	10	3	Sacrificed.
21	Left	12-19-23	6 x2.8x2	4	5	4-12-24	5 x2.5x2	4	15	3	Died from lobar pneumonia.
14	Left	10-26-23[1]	6 x4 x3	3	5	11-19-23	6 x3.5x3.4	5	24	4	
16	Right	10-30-23	6 x3 x2.5	3	4	11-28-23	5.5x3 x2.4	1 to 2	29	4	Died from lobar pneumonia.
20	Left	12-18-23	5.5x3 x2.2	3	5	1-19-23	5 x3 x2	2	31	3	Died from lobar pneumonia.
22	Left	2-21-24	6 x3 x2	3	4	4-13-24	6 x4 x3	2	43	4	
31	Left	7-25-24	5 x3.8x2.5	4	3	9-24-24	5 x4 x2.8	2	60	3	Sacrificed.
30	Left	7-24-24	6 x4 x2.5	3	4	10-24-24	6 x3 x2.5	2	90	2	
25	Left	4-24-24	7 x4 x3.5	4	5	8- 1-24	7 x3.8x3.8	2	100	3	
28	Right	6-18-24	6 x2.5x2	4	4	10- 9-24	5 x3 x2.5	1	112	3	
19	Left	11-28-23	7.5x4 x3.5	5	8	3-28-24	7 x4 x3.4	1	120	4	
27	Right	5-28-24	5.5x3 x2.5	4	15	10- 8-24	5.2x3 x2.5	1	130	3	
26	Right	5- 1-24	6.5x3.5x3	4	5	10- 3-24	6 x4 x2.8	1	156	3	Sacrificed.
23	Left	3-20-24	6 x4 x3.6	4	4	10- 2-24	6 x4.2x3.1	1	195	3	
5	Left	3-29-23	5.5x3 x2.5	3	8	12-20-23	6 x3 x3.5	1	266	3	Figure 5.

[1] Peritoneum opened during nephrotomy.

CHART II.—INTERRUPTED SUTURES IN KIDNEY CAPSULE OF DOGS FROM WHICH ONE KIDNEY HAD PREVIOUSLY BEEN REMOVED

Dog No.	Kidney	Date of nephrotomy	Size of kidney at nephrotomy (cm.)	No. of sutures	Bleeding time (minutes)	Date sacrificed	Size of kidney at autopsy (cm.)	Width of scar (mm.)	Days intervening	Blood in urine (days)	Remarks
14	Right	3- 6-24	8 x4.5x4	4	4	3-20-24	9 x6 x5.5	2 to 3	14	14	Sacrificed.
5	Right	3- 4-24[1]	8 x4 x3	4	5	3-20-24	6.8x4.2x3	2	16	4	
36	Left	12-11-24	8 x4 x3.6	5	4	1-15-25	7 x4 x3.5	1	35	3	
32	Left	11-26-24	7 x3 x2.6	3	2	1-25-25	7 x3.5x3	1	60	3	
23	Right	11- 3-24	7 x4 x3.4	5	10	1-12-25	7.2x4 x3.5	1	70	4	
30	Right	11-24-24	8 x4 x3	3	4	2-13-25	6.5x3.5x3	1	80	3	
28	Left	11-13-24	6.8x3 x2.6	4	3	2-10-25	6.2x2.8x2.4	1	90	3	
27	Left	11- 5-24	7 x4 x3.2	5	6	2-13-25	5.8x3.6x3	1 to 2	100	4	
22	Right	7-29-24	8 x5 x4	4	5	10-28-24	7.5x5 x4	1	120	3	Figure 3.

[1] Peritoneum opened during nephrotomy.

of incision with a large number of glomerular tufts and tubules well preserved, it seemed as though recovery might have been complete. According to Rehn, postoperative hæmorrhage occurs in from 10 to 12 per cent of cases.

CONCLUSIONS

1. Nephrotomy in dogs with interrupted Cushing sutures in the capsule is apparently a safe procedure.

2. Cessation of bleeding is brought about by the production of a physiological clot.

3. Postoperative hæmorrhage was encountered in 1 case (4 per cent).

4. Histological study of the nephrotomized kidneys shows a minimum destruction of kidney substances.

I am indebted to Professor Hugh R. Spencer for his valuable suggestions at all times.

REFERENCES

1. Beer, E. The use of fat to prevent sutures cutting into parenchymatous organs by underpinning. Surg., Gynec. & Obst., 1923, xxxvii, 694.
2. Carson, W. J., and Goldstein, A. E. Experimental nephrotomies. Southern M. J., 1924, xvii, 786.
3. Ciminata, A. Freie Muskeltransplantation in die Nephrotomie-Wunde. Ztschr. f. urol. Chir., 1922, ix, 433.
4. Jianu, Amza. Postoperative renal hæmorrhage. Surg., Gynec. & Obst., 1923, xxxvii, 652.
5. Magoun, J. A. H., Jr. Renal function following nephrotomy. Surg., Gynec. & Obst., 1923, xxxvi, 675.
6. Moore, J. E., and Corbett, J. F. The damage done to kidney by operation. Ann. Surg., 1911, liii, 373.
7. Ibid. An experimental study of several methods of suturing the kidney. 1913, lvii, 860.
8. Rehn, E. Ueber die Ursacher der Spatblutungen nach Nephrotomie und die Verhuetung (Klinik und Experiment). Berl. klin. Wchnschr., 1921, lviii, 1217.

SPONTANEOUS RUPTURE OF THE ŒSOPHAGUS

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RUPTURE of the œsophagus is of sufficiently rare occurrence to merit note. Since first Boerhaave reported the case of Admiral Baron Wassenair in 1724 there have been recorded in the literature 33 cases of spontaneous rupture of the œsophagus. It is not our purpose to review these cases here, as full reviews may be seen in the papers of McWeeney, Bowles and Turner, Roy, Whipham, and Menne.

Fitz in his paper held that, except in two cases reported by Mayer and Allan and by Grammatzki, up to that time no other cases had been definitely established of death having been caused by this condition. Sufficient cases have since been observed to demonstrate that spontaneous rupture of the œsophagus is a clinical entity and the immediate cause of death where it has occurred, although most textbooks, i.e. Choyce, Charles, Ochsner, Keen, Warbasse, are agreed that it seldom occurs apart from disease of the œsophagus usually called "œsophago-malacia" and sometimes "alcoholic œsophagitis."

While many have observed the pathological condition of the area where rupture has occurred, and in some cases have reported adjacent areas denuded of epithelium, and frequently remarked on the morbid condition of the œsophageal tissues, there has been a decided difference of opinion as to what extent these conditions are the predisposing cause of rupture and to what extent they are the result of postmortem changes.

Comparatively few histological findings have been reported apart from the excellent paper of McWeeney. Experimental work done by Mackenzie, Bowles and Turner, and Broesch, was designed to demonstrate the possibility of rupture by mechanical forces and the usual location of such rupture.

Having had an opportunity to observe recently a case of spontaneous rupture of the œsophagus and having made microscopic examination of the œsophagus and stomach we compared these findings with those observed after similar lesions of the œsophagus had been experimentally produced in two previously healthy animals. Sections were made in each case immediately at death and again after a period of 24 hours of postmortem degeneration in the cadaver to determine what degree of postmortem degeneration occurs due to autodigestion of the œsophagus and to what extent this can explain postmortem findings in cases of ruptured œsophagus.

CASE REPORT

The patient, as in so many of the reported cases, was a man of alcoholic habits. He had always been fairly healthy until about 6 or 8 years ago, when he

developed some form of gastric trouble characterized by occasional attacks of belching of gas with distress after meals. This condition was thought to have been due to peptic ulcer. For about a year before his death the patient had been in the habit of drinking an unusual amount of water, getting up three or four times each night for a drink. He had not consulted a physician about this. On October 15 he ate his lunch as usual and about 3 p.m. went out grouse shooting. He walked about on the prairie until 7 p.m., when he called at a farm house and was given a drink of cherry wine, which was the only nourishment taken since lunch. He then started back toward home and arrived there about 10 p.m. During the return journey he experienced slight abdominal discomfort and shortly after arriving home he vomited. During the act of vomiting he was seized with a most intense pain in the upper abdomen just beneath the lower end of the sternum. He exclaimed "my heart has burst," and declared he felt something tear within him. Great pain was immediately experienced and a physician was summoned at once. The patient did not toss about, but lay absolutely still and begged not to be moved in any way. During the next hour and a half he received by hypodermic injection over 1 grain of morphine without any material relief from the excruciating pain. The pulse was 86 and the respirations were observed to be short, catchy, and rapid, but were not counted. The systolic blood pressure was 130, the diastolic 75. His color was good. There was no rigidity or tenderness of the abdomen. The pain continued intense throughout the night and was so agonizing that it was impossible to remove the patient's clothing. Early in the morning he was again given morphine and later was brought to hospital. When he was admitted to hospital pain was the principal symptom. The pulse was now 140, the respirations 60. The abdomen was a little distended but not rigid except immediately over the diaphragm. The lower abdominal wall was quite soft. He had not vomited again. The breath sounds over the anterior and lateral surfaces of the left side of the chest were suppressed. The heart did not appear to be abnormal or displaced. The leucocyte count was 9,200. The urinalysis showed 1.2 per cent sugar, a faint trace of albumin, a few pus cells, and a few granular casts. The blood sugar was .52 per cent, creatinine 4.5 milligrams per 100 cubic centimeters.

These findings showed the presence of a diabetic condition for which he had never consulted a physician nor had any treatment. The patient was so ill that operation was deemed inadvisable. He grew steadily worse and in spite of large doses of morphine the pain was never controlled. The pain at one time radiated round to the left side of the chest and the left shoulder, and down the left arm. He died at 8 p.m., a little less than 20 hours after vomiting ushered in the attack.

Autopsy findings. At the autopsy, which was performed 12 hours after death, the following points were noticed: There was no emphysema of the skin. In the abdominal cavity there was no free fluid nor sign of any inflammatory condition. The abdominal organs showed no evidence of disease. The right pleural cavity, the right lung, and the heart showed no abnormality. The left pleural cavity was practically filled with a dark reddish brown fluid containing numerous particles of meat and other solid foods. The lung on the left side was completely collapsed and when the chest was first incised air rushed in showing a negative pressure. A perforation 1 inch in diameter was found about 1 inch above the diaphragm and on the left side of the œsophagus leading directly into the pleural cavity. The stomach contained a considerable amount of dark reddish brown fluid and it was easily possible to force this fluid through the rupture of the œsophagus into the left pleural cavity.

Sections were taken through the lesion of the œsophagus, the œsophagus just above the lesion, through the cardiac orifice of the stomach, and through the fundus of the stomach. Upon examination the section from the upper œsophagus showed abundant cellular exudate between the muscle bundles. This was much more pronounced in the outer than in the inner layers. These inflammatory cells were mostly mononuclear in type, but there were also numerous polymorphonuclears. The epithelium appeared normal. In sections stained by Gram's method enormous numbers of bacteria could be seen in the outer layers of the œsophageal wall, a few in the inner layers, and none at all on the surface of the mucous membrane. Most of these bacteria were large Gram-positive bacilli, with a few Gram-positive diplococci. Section through the lesion showed such extensive destruction and disintegration of the wall of the œsophagus that it was not possible to be certain which was the inner and which the outer coat. All trace of the mucous membrane had disappeared. In the middle of the muscular coat there was a large collection of inflammatory cells mostly polymorphonuclears with a smaller number of mononuclears. In sections stained with Gram there was again the same intense bacterial invasion. In addition there were considerable numbers of yeast-like bodies, some in the process of budding.

Section through the cardiac orifice resembled the histological picture seen at the site of the rupture. The mucosa had entirely disappeared and the muscle tissue was disintegrated and infiltrated with inflammatory cells and bacteria. Section through the fundus of the stomach showed the serous, muscular, and submucous coats to be quite normal, with no trace of inflammation. The mucous membrane showed a certain amount of degenerative changes as evidenced by desquamation of the surface epithelium and loosening of the cells lining the glands. No evidence of inflammation could be found in the mucosa. The difference between this section and those taken from the cardia and the œsophagus was most striking.

EXPERIMENTAL OBSERVATIONS

In the records in the literature covering thirty-three cases of rupture of the œsophagus there appeared to be a question of how many of the histological and anatomical changes were due to pre-existing disease, and how many to postmortem softening and degeneration. It therefore occurred to us to study the effect of experimental lesions of the healthy œsophagus in the living animal and observe what degree of change occurred postmortem. We made a copper olive of such size that it would just pass the larynx of a small dog. This olive was cut half way through with a saw in such a way as to make a sloping slot the distal apex of which emerged at the widest part of the olive. A piano wire was fastened into the small end of the olive to provide control of its position in the œsophagus. A Maissoneuve urethrotome was then inserted in the slot, where its cutting surfaces were concealed, leaving the handle parallel with the wire of the olive. The animal being anæsthetized, the apparatus was passed down the œsophagus in this position, and when the correct location had been reached the olive was held stationary and the knife pushed onward causing it to emerge from the apex of the slot and perforate the œsophagus. In this position the apparatus was then withdrawn for a distance of 1 inch thus producing an incision 1 inch in length through the œsophageal wall on the right side. The knife was then withdrawn within the olive and the whole apparatus removed without causing further injury to the mucous membrane.

Upon recovering from the anæsthetic the animal was noticed to limp on the right fore leg and to jerk its head around to the right side. It was much less active than before the operation, and refused all food. Shortly after recovering from the anæsthetic it was given morphine in order to induce vomiting. The vomitus consisted of food particles, mucus, and streaks of blood. It did not vomit again. After 23 hours the animal was chloroformed and a postmortem was performed at once.

The autopsy showed no evidence of emphysema. Upon removal of the sternum it was at once seen that numerous fine fibrinous adhesions traversed the anterior mediastinum. The right pleural cavity was also crossed by numerous adhesions of a similar character. In the interstices between these adhesions and filling the right pleural sac there was a large quantity of thin blood-stained fluid. This fluid was removed and measured 154 cubic centimeters in volume. It contained numerous Gram-positive cocci and large Gram-positive bacilli. The right pleura was intensely injected and inflamed and covered with a fine layer of fibrin.

Following the same method, a second animal was used, and a lesion of the œsophagus produced about 1 inch in length on the right side 1.5 inches above the diaphragm. The animal refused to move about and lay in a cramped curled-up position wedged into a corner of the kennel. A frequent catch in the breath was observed. He became acutely ill and died 20 hours after operation.

An autopsy was performed and revealed exactly the same conditions as were found in the previous animal. The left pleural cavity and lung were quite normal in appearance, there was again no evidence of emphysema, the right pleural cavity was filled with a sanguineous fluid, and the anterior mediastinum and pleural cavity contained many recently formed adhesions. The right lung was collapsed against the posterior thoracic wall. A linear incision 1 inch in length passed through the œsophagus about 1.5 inches above the diaphragm on the right side. There was no blood in the stomach. Sections through the lesion again showed no indication of any inflammatory reaction.

If a conclusion may be drawn from only two experiments, we may say in the first place that postmortem alterations are not responsible for the gross and microscopic changes observed in human cases. In the second place it would appear probable that spontaneous rupture of the œsophagus is preceded by some inflammatory lesion which weakens the œsophageal wall, for in our experimental animals the inflammatory changes which are so characteristic of the human cases were completely absent. The right lung was of much smaller volume than the left and was compressed against the pos-

terior thoracic wall by the large amount of fluid. The left thoracic cavity showed no adhesions, the left pleura appeared normal, the lung was not collapsed, and no exudate was present. The œsophagus was found perforated by a linear incision about 1 inch in length on the right side 2 inches above the diaphragm. There was no blood in the stomach and nothing of interest in other organs.

For microscopic examination sections were made of the œsophagus at the site of the lesion, above the lesion, and below the lesion, from specimens taken immediately after death and repeated from specimens taken after 24 hours of postmortem decomposition *in situ* in the cadaver. Examination of a section through the lesion taken immediately at death showed no indication of inflammatory reaction. The stratified epithelium was intact and the underlying tissue showed neither congestion nor an inflammatory exudate. Sections of the œsophagus taken from above and below the lesion at death showed the same conditions as those found at the lesion. Of the sections from material taken 24 hours after death, those below and through the lesion showed no change in the histological picture; that above the lesion showed evidence of degeneration, such as pyknosis of the nuclei and disintegration of the cytoplasm.

DISCUSSION BY T. H. WILLIAMS

There has been considerable speculation as to the cause of the rapidly fatal termination in cases of spontaneous rupture of the œsophagus as compared with the protracted and frequently non-fatal course of ulceration into the œsophagus of some tuberculous or other chronic inflammatory nature. The cases so far reported have usually shown at autopsy a large amount of fluid in the pleural cavity, which in some cases contained food particles and has been explained as due to the passage of gastric contents through the lesion of the œsophagus into the pleural cavity. This explanation hardly appears to be an adequate one. In both our experimental cases the pleural cavity was filled with fluid, but this was alkaline, contained no gastric contents, was of the nature of an exudate, and teemed with bacteria, while the stomach contained no similar fluid but on the contrary, a dried curdy mass. The rapid throwing out of this exudate together with the extreme degree of pleural inflammatory reaction seen within 24 hours in these two cases seems to indicate that death is due to a sudden attack by virulent organisms within an undefended, closed, and toxin-absorptive cavity in which no immunity has been raised. In those cases of slow ulceration into the œsophagus, which have been reported as terminating favorably, this is prevented by the formation of a protecting layer of granulation tissue.

The presence of this infected fluid in the pleural cavity would suggest that surgical measures are indicated wherever a diagnosis of spontaneous rupture of the œsophagus can be established with any degree of certainty. Pleural puncture and aspiration of the exudate, indicated to verify a suspected diagnosis of rupture, followed by efficient drainage of the infected cavity might result favorably in those cases in which a simple linear tear of the œsophagus has occurred.

CONCLUSIONS

1. Rupture of the œsophagus is a rapidly fatal condition, usually resulting in death in the course of 24 hours.

2. The advanced histological changes in the edges of the lesion found both in our own case and in those described in the literature cannot be explained merely as the result of postmortem digestion. Our experimental work has shown that when rupture of the œsophagus is produced in a healthy animal, these changes do not occur.

3. It appears probable that spontaneous rupture is preceded by some inflammatory process which weakens the œsophageal wall.

4. A possible method of surgical treatment for an otherwise hopeless condition is suggested.

REFERENCES

Bowles and Turner. Brit. M. J., 1900, i, 763.
Brosch. Arch. f. path. Anat., 1900, clxii, 114.
Fitz, R. H. Am. J. M. Sc., 1877, cxlv, 17–36.
Mackenzie, M. Diseases of the Throat and Nose, vol. ii.
McWeeney, E. J. The Lancet, 1900, i, 161.
Menne and Moore. Arch. Ped., 1921, xxxviii, 672.
Roy, D. W. Lancet, Lond., 1911, ii, 1765.
Warbasse, J. P. Surgical Treatment, vol. ii, 432.
Whipham, T. R. C. Lancet, Lond., 1903, ii, 749.

BACTERIOLOGY OF THE THYROID GLAND IN GOITER[1]

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TISSUE bacteriology of the thyroid gland appears to be a new method of investigating the etiology of goiter. Since the work of Farrant and McCarrison, there has been no doubt but that a "contagium vivum" plays an important part in diseases of the thyroid gland. These investigators were the first to advance definite evidence of a specific bacterial agent as the cause of thyroid hyperplasia. The constant finding of a mutant colon bacillus in fæces of goitrous patients and the results of animal experimentation led these investigators to believe that prolonged ingestion of the bacillus from contaminated waters causes endemic goiter, because its toxin affects the thyroid gland. Galli-Valerio has shown that goiters can be produced in rats by the injection of bacillus pseudopestis murium, isolated from the waters of the Jura Mountains. The bacillus was found to have a specific local effect on the thyroid tissue, bringing about tumefaction and abscess formation.

Gilbride, in 1911, made a bacteriological study of 14 cases of goiter. He isolated micrococcus tetragenus from the thyroid gland in one case of exophthalmic goiter, and streptococcus vermiformis of Sternberg in one case of cystic goiter. In none of the other 12 cases was a growth obtained.

Rosenow, in 1914, isolated a diphtheroid non-hæmolyzing streptococcus from the thyroid gland in 25 of 32 cases of goiter (mostly exophthalmic goiter) in man, and in 8 of 12 dogs having goiter. These organisms, when injected repeatedly into dogs over periods ranging from 20 to 70 days, produced goiter, loss in weight, and diarrhœa. In one dog, softening, pulsation, and bruit of the thyroid, associated with marked tachycardia and tremor, also developed. Microscopically there were noted vacuolization and irregular staining of the colloid, colloid within vessels, areas of necrosis, and a variable degree of hyperplasia.

Clinical evidence of an association between infection and disease of the thyroid has not been wanting. Thus, Vincent called attention to the frequent enlargement of the thyroid gland in acute articular rheumatism. Albertin, Bech, and Acchioté also attributed certain lesions of the thyroid gland to acute rheumatism. Halsted emphasized the importance of infection as the cause of hyperplasia of the thyroid. Beebe found that 40 per cent of the patients with hyperthyroidism gave a history of repeated attacks of acute tonsillitis. Norregaard found localized infections, usually in tonsils, in a group of 35 cases of goiter. C. H. Mayo also emphasized the relationship between focal infection and hyperactivity of the thyroid gland. Billings reported cases in which goiter disappeared after tonsillectomy.

It occurred to me that the difference in the results obtained might be explained by differences in the technique employed. Gilbride planted pieces of tissue in various mediums which did not afford a gradient of oxygen tension, whereas Rosenow inoculated emulsion of the tissue in mediums that afforded not only aerobic and anaerobic conditions, but a gradient of oxygen tension.

I used the method of Rosenow in all cases, and also the methods used by Gilbride, as controls, in selected cases.

TECHNIQUE

Cultures from the tissues were prepared under sterile conditions. Immediately after excision of the gland by the surgeon, the specimen, with the least handling possible, was covered with sterile gauze or a towel and taken to the laboratory. By means of a hot blade, a large surface of the gland was seared. With a sterile Pasteur pipette, the seared surface was punctured, fluid for culture was drawn, and then a portion, about 1 cubic centimeter, was emulsified. With sterile instruments, the tissue was removed by cutting into the seared surface. The excised tissue was passed rapidly through a flame, then washed three times in normal sodium chloride solution, placed in a mortar in a sterile air chamber and emulsified with normal sodium chloride solution and

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sand. The pipetted fluid and emulsion were inoculated into the following mediums: glucose brain broth, glucose broth, meat infusion, and soft glucose brain agar (0.3 per cent) in tall columns (10 to 12 centimeters), and plain broth in low columns (3 to 5 centimeters). Dextrose broth in bottles containing 150 cubic centimeters was inoculated with the residue of the emulsified tissue. Anaerobic cultures were made on blood agar slants by the pyrogallic acid method. Aerobic cultures on blood agar plates of the pipetted material and emulsion were also made in some instances, but this was not done as a routine, because the organisms which were being sought required a certain gradient of oxygen tension for their growth.

The glucose-brain-broth medium was prepared from Difco dehydrated broth to which 0.2 per cent glucose and about the equivalent of 2 centimeters of calf brain with several small pieces of marble were added before sterilization. The glucose-brain-agar was prepared from meat infusion to which 0.3 per cent agar (just sufficient to jellify) and calf brain were added. The glucose (0.2 per cent) broth, plain broth and agar to which 5 per cent horse blood was added before pouring, were made from extract of beef and peptone (Difco). All mediums were adjusted to hydrogen-ion concentration 6.8 to 7.2, sterilized at 20 pounds pressure for 20 minutes, and clarified by means of a continuous feed centrifuge. In inoculating these mediums, I purposely varied the amount of inoculum in order to make the range of oxygen tension and other conditions as wide as possible. The cultures were incubated at 37 degrees C. for from 1 to 7 days and were examined daily.

RESULTS OF CULTURES

Cultures were made of the thyroid tissue from 50 goiters. Most of them were colloid or adenomatous goiters that had existed for a long time. In only 3 cases did the cultures fail to show growth. Positive results were obtained in all of the rest. In accordance with Rosenow's previous findings, the predominating flora was found to be of streptococcal morphology. Organisms belonging to this group were isolated in 31 cases. Pneumococci were present in 5 additional cases, Welch's bacillus in 2, a diphtheroid bacillus, bacillus pyocyaneus, and micrococcus tetragenus in 1 case each, and staphylococci in 7 cases. Tall columns of glucose-brain-broth and glucose-brain-agar, mediums affording a gradient of oxygen tension, yielded the highest percentages of positive results, the former yielding growth in 25, the latter in 28 of 34 cases in which the results were tabulated according to mediums. Glucose broth in tall columns gave the next best results, yielding growth in 14. Plain broth in low columns showed growth in only 4 cases, meat infusion in 5, aerobic blood agar in 4, and anaerobic blood-agar slants in 8. The streptococcal growth in broth was often seen to begin in the bottom of the tall tubes and extended to the top in from 12 to 24 hours. The colonies of streptococcus in the shake cultures of the soft glucose brain agar were usually few, and were always situated in the lower levels of the medium. Organisms which did not grow on blood agar on direct plating of the emulsions nor in the aerobic part of the shake cultures of the soft agar, would do so on the second or third subcultures. In a few cases, this was impossible and the organisms were strictly anaerobic.

Successful cultures of the streptococci on blood agar plates revealed both the green-producing and hæmolyzing varieties. The colonies of the viridans instead of being pinpoint in size, dry and elevated, were fairly large, shiny, and only slightly elevated, but were surrounded by a typical green halo. The zone surrounding the colonies of the hæmolyzing types was usually hazy and narrow, in sharp contrast to that of the typical hæmolytic streptococcus.

The results from planting pieces of tissue, according to the method of Gilbride, in low columns of bouillon containing calcium chloride and in salt solution were usually negative, and the streptococcus was not obtained.

Morphologically, the viridans and hæmolytic streptococci appeared much alike and produced short chains of 3, 4, or 5 gram-staining cocci of uniform size. Only in a few cases were long chains of 10 to 12 cocci encountered. The diplococcus isolated in 5 cases was gram-positive, about the same size as the

streptococcus, and in some cases showed a distinct capsule. It produced small pinpoint, slightly elevated colonies on blood agar surrounded by a green zone. It was also highly sensitive to oxygen in the primary culture.

The animal experiments are too few to be of much value but since the results corroborate, in important respects, those obtained by Rosenow in this and other fields, a brief summary of them is given.

Freshly isolated cultures of the streptococcus in glucose-brain-broth from 4 cases were injected intravenously into rabbits. One additional strain was injected on isolation after a number of transfers on artificial mediums, and one strain after prolonged cultivation and one animal passage. Six rabbits were injected with from 2 to 5 cubic centimeters each, of the freshly isolated strains. Of these, 5 died from the effects of the injection. A variable degree of hyperæmia and swelling of one or both lobes of the thyroid gland was found in all, and was marked in 2. The streptococcus was recovered from emulsions of the thyroid gland in all and from the blood in 4. No gross lesions of the viscera developed. Six rabbits were injected in a similar manner and in like dosage with the streptococci after several subcultures. Of these, all remained well and were chloroformed in from 1 to 2 weeks. Only 1 showed changes in the thyroid gland, and none showed lesions in other organs. The streptococcus was isolated from emulsions of the thyroid in 4, and from the blood in 3.

COMMENT

The predominance of the streptococcal flora seems to be of some significance since enlargement of the thyroid gland and true thyroiditis are so commonly noted in diseases that have been shown to be due to streptococci or are associated with localized streptococcal infections.

The discrepancy between the results obtained by Gilbride and Rosenow is explicable on the basis of differences in their technique. From the results of this bacteriological study and experimentation, it would seem that localization of certain organisms, especially those belonging to the streptococcal group in the thyroid gland, may be an important factor in the pathogenesis of goiter.

BIBLIOGRAPHY

1. Acchioté, P. Rhumatisme chronique et insuffisance thyroidienne. Rev. neurol., 1907, xv, 473–477.
2. Albertin, A. Le corps thyroïde et le rhumatisme articulaire aigu. Paris: J. Rousset, 1911, 131 pp.
3. Bech. Deux cas de thyroïdite aigue rhumatismale. Provence méd., 1912, xxiii, 106.
4. Beebe, S. P. Preparation of a serum for the treatment of exophthalmic goiter. J. Am. M. Ass., 1906, xlvi, 484-487.
5. Billings, F. Focal infection; its broader application in the etiology of general diseases. J. Am. M. Ass., 1914, lxiii, 899–903.
6. Idem. Focal Infection; the Lane Medical Lectures. New York: D. Appleton and Co., 1916, 178 pp.
7. Farrant, R. The relation of the thyroid to antitoxin. Lancet, 1913, ii, 1820–1822.
8. Idem. The pathologic changes of the thyroid in disease. Brit. M. J., 1914, i, 470–475.
9. Galli-Valerio, B. Bacterium pseudopestis murium n. sp. Centralbl. f. Bakteriol., 1 Abt., Orig., 1913, lxviii, 188–194.
10. Idem. Infection á B. pseudopestis murium chez les rats et goître. Centralbl. f. Bakteriol., 1 Abt., Orig., 1913, lxx, 278–281.
11. Gilbride, J. J. Cultures from the thyroid gland in goiter; a bacteriologic study of fourteen cases. J. Am. M. Ass., 1911, lvii, 1988.
12. Idem. Ten cases of goiter; a bacteriological study of cultures and of stained sections from the thyroid gland. New York M. J., 1913, xcvii, 662–663.
13. Halsted, W. S. Reconsideration of the question of experimental hypertrophy of the thyroid gland, and the effect of excision of this organ upon other of the ductless glands. Am. J. M. Sc., 1914, cxlvii, 56–62.
14. Mayo, C. H. Surgery of the thyroid. J. Am. M. Ass., 1913, lxi, 10–12.
15. McCarrison, R. The Etiology of Endemic Goitre. London: John Bale, 1913, 216 pp.
16. Idem. The Thyroid Gland in Health and Disease. New York: William Wood and Co., 1918, 286 pp.
17. Nørregaard, K. Thyroiditis. Ugesk. f. Laeger, 1915, lxxvii, 51–74.
18. Rosenow, E. C. The newer bacteriology of various infections as determined by special methods. J. Am. M. Ass., 1914, lxiii, 903–908.
19. Idem. Results of experimental studies on focal infection and elective localization. Med. Clin. North America, 1921, v, 573–592.
20. Vincent, M. H. Rapports de la maladie de Basedow avec le rhumatisme aigu. Bull. et mém. Soc. méd. d. hôp. de Par., 1907, xxiv, 1286–1295.

COMMON MISCONCEPTIONS IN RADIOTHERAPY[1]

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AMONG surgeons and internists there is some confusion concerning the relative advantages of radium and X-rays in the treatment of many diseases. We often read articles by physicians who advocate X-rays in dealing with a certain condition and other articles favoring radium just as strongly in the same disease. Under such circumstances it is but natural that an impression should arise that the two agents conflict, when really they do not.

As soon as the therapeutic value of radium became recognized, certain members of the profession hastened to make use of this valuable substance. Some of them were radiologists while others were medical or surgical practitioners without special training in radiology. Some were equipped and trained to use both agents, some to use one agent or the other, while others, possessing one or both agents, had no training. What would be more natural, therefore, than that the possessor of such an expensive substance as radium should employ it and advocate its use as much as possible, or that one with facilities only for X-ray treatment should speak or write of it exclusively? Moreover, there are diseases or phases of the same disease, in which either agent may be used to produce effects more or less similar in character and degree. Thus the sources of confusion and misunderstanding are at once made apparent. By their nature and the circumstances surrounding their production, both agents possess certain advantages and disadvantages.

Radium is available in measurable quantities of radio-active substance either in the form of a salt (radium element, in metal capsules or needles), or in that of a gas (radium emanation, in glass capillaries). Its supply, however, is limited and its cost almost prohibitive. Now, radium in whatever form is, like all other radiations, subject to the inverse square law, by virtue of which the intensity of its rays diminishes according to the square of the distance. Therefore, if we apply any unit of radium to the surface of the body, and leave it in position long enough to deliver the maximal dose that the skin will tolerate without damage, calling such a dose 100 per cent, the percentage of this dose reaching certain depths beneath the surface will be as shown in Figure 1.

In Figure 1 may be seen a double horizontal line representing the skin, and two sets of circles at different distances from the center of the diagram. In each case the center consists of a unit of radium. In A the radium unit is in immediate contact with the skin. If then a dose is given to the limit of skin tolerance, and if such a dose at a distance of 0.5 centimeter from the skin is considered as 100 per cent, the dose at 1.0 centimeter will be only 25 per cent; and at 2 centimeters only 6.25 per cent of the surface dose. In B the distance between the unit of radium and the surface of the skin has been increased to 2.5 centimeters. Under these conditions the time necessary to deliver a full dose to the skin is much longer. Moreover, the effective dose 2.5 centimeters below the surface (5 centimeters from the radium unit), although much greater than when the radium unit is in immediate contact with the skin, is only 25 per cent of the full surface dose.

The percentage of the 100 per cent dose reaching different levels below the surface can be altered by increasing or decreasing the amount of filtration through which the rays have to pass, and by increasing the distance between the radium unit and the surface, but such increase involves a longer time of exposure to deliver a 100 per cent dose to the surface. Indeed, to attempt any significant increase of the depth dose percentages by increased filtration and distance requires such an increase in the time of exposure as to be wholly impracticable. The only possible way to overcome this obstacle would be to use a larger quantity of radium, but its cost makes this prohibitive. Were we not

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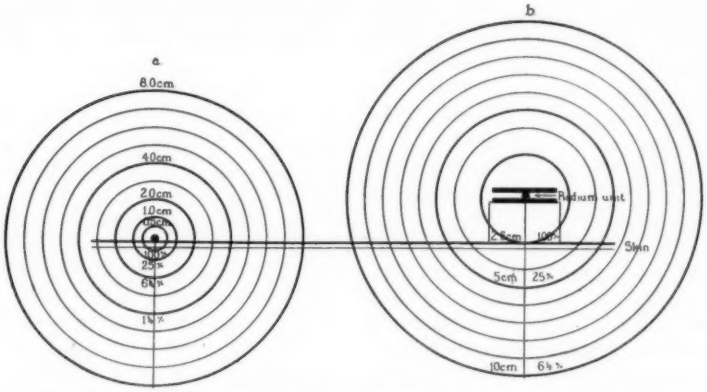

Fig. 1. Effect of distance on radium dosage (inverse square law).

hampered by considerations of supply and cost, methods might be devised to solve the physical problems. We might even learn how to neutralize the danger of handling such quantities of radium. For the time being, however, we must adapt our methods to the facilities available and to the physical endurance of our patients.

From the foregoing it can be easily understood why the maximal usefulness of radium is limited to a short radius. The chief indication of radium is, therefore, for lesions or tumors of limited size, on or near the surface of the body or accessible from the outside, the extent of which can be determined with a fair degree of accuracy. It is most useful when it can be introduced directly into the substance of the lesion in such a manner as to deliver to every part an adequate and fairly uniform dose. Sometimes the radium can be concentrated in one large unit, but generally the implantation method is more effective, many units, each containing a small quantity of radium element or emanation, being introduced at regular intervals throughout the tumor. If the lesion is large, or if, as in many malignant growths, its shape is irregular and its extent ill-defined, and especially if it is below the surface, radium is not the agent of choice. Under such conditions X-rays are more efficacious, although in many cases both agents can be combined advantageously. For example, in carcinoma of the uterine cervix, the indications for radium are ideal, because through the cervical canal the radio-active unit or units can be placed in the very center of the diseased area. It can thus exert full action in every direction, with great benefit in many cases; yet, on account of the inexorable influence of the law of the inverse square, the maximal effect is limited to a radius of between 1.0 and 2.0 centimeters. If, therefore, the zone of malignant degeneration extends farther, and its outlying elements do not receive sufficient radiation to bring them under control, an attempt is made to compensate for this deficiency by giving X-ray treatment from without.

When, because of metastasis to axillary and supraclavicular nodes, carcinoma of the breast becomes a problem for the radiologist, how should it be treated? To attack such widespread dissemination with radium would require a quantity seldom available, because, in order to be effective, it must be used at a distance. The great cost of such treatment would be justified only by a higher degree of effectiveness than we are warranted to expect from past experience. Such cases are best dealt with by means of X-rays, but it is sometimes possible to increase the effect and shorten the period of treatment by also using radium units buried throughout the primary tumor.

Radiotherapy before and after surgical amputation of an operable carcinomatous breast should be carried out by means of

X-rays, because it is essential to irradiate a large territory as uniformly as possible. This would not be feasible with radium unless the quantity was sufficient to enable its use at a distance, like an X-ray tube. The same principle applies in the treatment of recurrent or metastatic deposits, because it is naturally and justly assumed that the entire lymphatic drainage is affected.

At short range, radium has a more intense action than X-rays, and this advantage is sometimes most useful. For example, when repeated X-ray treatment no longer influences superficial carcinomatous nodules, radium may still produce the desired effect. Seldom is the reverse true. This advantage of radium can often be utilized in the treatment of many diseases, or of different phases of the same disease. Thus, in a superficial recurrence of carcinoma or other forms of malignancy, radium may often be employed with at least temporary succcess after the effectiveness of X-rays has become neutralized by the increasing tolerance of the lesions. But, since radium itself can seldom arrest the activity of malignant cells permanently, it should be reserved until the power of X-rays has been completely expended. Control of malignant deposits can thus be maintained for a longer period. This does not apply to solitary foci which sometimes can be permanently overwhelmed by a massive attack with radium.

In Hodgkin's disease and in lymphosarcoma the lymph nodes throughout the body may be diseased. Regardless of the apparent limits, it is best, at the outset, to treat all the main groups of lymph nodes, whether enlarged or not, including those in the mediastinum and along the dorsolumbar portion of the spine. Such treatment is generally most successful with X-rays. In certain cases, however, the enlargement of the nodes in one region may be so great as to produce pressure symptoms which should be relieved as quickly as possible, when the greater superficial action of radium can often be brought to bear with good effect, but experience has shown that too rapid reduction in the size of such nodes is not always an advantage to the patient. Clinical judgment in estimating the stage of the disease is an important factor in deciding how intense and how concentrated the treatment should be.

Tumors or lesions deep within the trunk, whether thoracic or abdominal, are more effectively treated with X-rays than with radium, and this in spite of the great radiosensitiveness of certain forms of tumors, such as the malignant embryoma, or seminoma. This variety of tumor is so sensitive to radiation that even its secondary manifestations yield readily to moderate doses of either X-rays or radium. Although striking regression often follows the application of radium to the surface of the abdomen, X-ray treatment is preferable, because the full extent of the malignant dissemination cannot be ascertained, and it is essential to irradiate, not only the part of the tumor which can be felt through the abdominal wall, but also the part in the surrounding tissues.

The choice between radium and X-rays in dealing with benign lesions rests on their extent, volume, and depth. Small keloids are best treated with radium, while X-rays are preferable for large keloids. When uterine fibromyomata adjoin the mucosal surface, radium inserted into the cavity of the organ is generally sufficient. X-rays are more beneficial when the tumors are subperitoneal. But in most cases both agents should be combined, because it is so seldom possible to determine the location of the tumors accurately.

STIMULATION

The idea that radium and X-rays can stimulate cells is often expressed or implied by physicians. They either believe that such stimulation is actually produced or that it may follow treatment of a malignant tumor and increase its rate of growth. I recently heard two radiologists on the witness stand swear that the action of these agents may be stimulating or destructive. I am quite certain that if these two radiologists had been asked whether they had ever seen evidences of stimulation resulting from radium or X-ray treatment, they would have promptly answered "no." We sometimes hear radiologists speak of a "stimulating dose"; yet, if they were to specify the amount of a

stimulating dose of X-rays or of radium, they would be unable to do so. How, then, has such a belief become so widespread and whence has it arisen? Surely there must be some fire to account for the smoke.

The action of radium and X-rays on plant and animal life has been the subject of many experiments. When we scan the printed records, we find, for instance, that when blood is irradiated there occurs within 24 to 48 hours a slight leucocytosis followed by a pronounced leucopenia lasting many days. Arntzen and Krebs have recently shown that when germinating peas are subjected to very small doses of X-rays, their growth during the first 24 or 48 hours is slightly more rapid than that of controls, but that after this, their rate of growth diminishes steadily. Similar results have been reported by almost all experimenters, the only variation being that, with larger doses, the transient increase in rate of growth does not take place. In nearly all such studies it has been found impossible to prolong this transient phase of apparent stimulation, which varies somewhat according to the sensitiveness of the individual plant or animal. Whether experimenting with peas and other plants, or with amœbæ, frog eggs, or other animal forms, the mature products have been always either normal or deficient in different respects (generally slow growth and failure to reach full development); no one has ever been able to produce in this manner larger specimens of any variety of plant or animal, or to cause them to mature in less time than the unexposed controls. Moreover, the results in growing plants and in all forms of animal life are wholly in accord with our experience with radiotherapy in human beings. No one has ever brought forth the slightest evidence in favor of the theory of stimulation in the sense of continued acceleration of cell life. Certainly, in my experience, there has never been anything which could, even remotely, suggest such a possibility.

Since early in 1896 the skin of thousands of human beings has been exposed to every conceivable dose of X-rays. Were stimulation by such means possible, surely by this time there should have appeared a new race of men with thick skins and long body hair; but, so far as I am aware, the human skin is approximately the same now as it was in 1895. Radium and X-rays may cause the hair to fall out temporarily or permanently, but, unfortunately, cannot increase the growth of hair. The activity of the sweat glands also can be diminished by exposure to radiation, but no one has thus been able to make them secrete more freely. All the changes resulting from the action of radium and X-rays on tissue cells are degenerative in character. Repeated over-exposure may, it is true, cause such degeneration to become malignant. This has occurred in radiologists who have been careless of themselves, and a few instances have occurred in patients subjected to the rays frequently and over a long period of time. This is not stimulation in the sense of increased activity, but aberrant function due to chronic irritation. In considering stimulation with reference to the effect of radiation on tumors, it has never been shown that the rate of growth of a tumor can be accelerated in this way.

DIRECT OR INDIRECT BIOLOGICAL EFFECTS

The power of an idea is a marvelous thing. Even if the idea is wholly or partially false it is often astonishing how far it will travel before the truth can overtake and either destroy or correct it. When the true explanation of any scientific phenomenon is finally reached, its mechanism is generally found to be much simpler than that of most of the hypotheses previously held concerning it. The simple, obvious thing is generally the last to be thought of. Too often we forget that a hypothesis is nothing more than a plausible, but fanciful, explanation of certain observable phenomena, based partly on certain known facts, partly on circumstantial evidence, and partly on the law of probability. Too often a quarter or a half truth is seized on and, by the generous admixture of an artificial mortar made up largely of wisps of imagination, is erected into a figure supposedly representing the truth.

An example of this is seen in the present attitude of many radiologists toward the mechanism of the biological effects produced

by radiation. When living tissues are subjected to X-rays or to radium, certain changes follow, and in a definite sequence. If, for instance, the skin is treated, the exposure will, according to the dose, be followed by epilation, by erythema and atrophy, or by ulceration. No one would venture to attribute such effects to anything but reaction to the rays on the part of the tissues thus exposed. Yet as soon as we approach the question of malignancy, the idea is advanced that the biological effect of the rays is caused by the elaboration of protective substances leading to immunity. And this idea, once enounced, is copied and repeated until the utmost confusion reigns whenever the subject is brought up.

That the body attempts in various ways to neutralize or to limit the activity of malignant cells is undeniable. Evidence indicates that the blood and the tissue juices possess a definite lytic power against tumor cells just as they do against bacteria. There is also substantial evidence that local defensive measures are instituted, but these are subordinate to, and dependent on, the general defense mechanism. Among the local defense measures are: (1) differentiation of the neoplastic cells, (2) lymphocytic infiltration, (3) hyalinization, and (4) fibrosis. MacCarty has shown that the malignancy of a tumor depends on the proportional strength of these factors. Murphy and his co-workers have demonstrated that, under certain conditions, exposure of a tumor to X-rays tends to intensify the lymphocytic factor of defense.

Cases are occasionally seen in which regression of a malignant deposit in one part of the body after irradiation is accompanied by similar changes in an untreated lesion in a distant region. Although such instances are not common, that they occur at all shows that with the destruction of one element of a malignant process there may be added to the blood or lymph something which may increase the natural power of resistance. Unfortunately, experimental attempts to produce such a desirable result have met with but little success. Certainly, there is no proof that the systemic defense against cancer can be increased by radiation. But admitting that such factors exist and play a part in the pathological physiology of malignant tumors, we cannot find in them a satisfactory explanation of the sequence of changes that occur in a tumor after treatment by radium or X-rays. Indeed most of our positive information points to the conclusion that the cellular changes brought about by radiation in the case of malignant tumors are of the same order as those produced in normal cells, subject, of course, to the modifications imposed by differences in cell metabolism peculiar to the type of neoplastic process. Therefore, how can we write and speak of their biological effects as being due primarily to an immunity reaction?

On the contrary, a mass of evidence exists tending to show that the major factor in the effect of X-rays or radium rays on cancer cells is a direct one. Mention has been made of the action of such rays on normal skin; it is impossible to see how such effects can be considered in any other way than as direct effects.

In the experiments of Martin and Rogers, and of Warren and Whipple, in which destruction of the intestinal mucosa followed X-ray exposure under certain conditions, how can we interpret such results otherwise than as a direct effect? If this is true of normal tissues what basis have we for believing that diseased tissues behave differently? When proliferated connective tissue is found to have replaced masses of cells characteristic of some form of malignancy, why should we consider the proliferation as due to indirect stimulation of connective tissue by the rays when pathology teaches us that such replacement is a universal phenomenon following degenerative processes? Why invoke a mysterious, intangible mechanism, for which there is no adequate basis, when clinical and experimental data support the more simple view that radiation acts directly on the malignant cells, tending to destroy them or to interfere with their metabolism, and that their disintegration and subsequent replacement by connective tissue follows one of the main laws of general pathology?

BIBLIOGRAPHY

1. Arntzen, Leif, and Krebs, Carl. Investigation into the biological effect of filtered and unfiltered X-rays, as measured on peas. Acta Radiol., 1925, iv, 5–31.
2. MacCarty, W. C. Factors which influence longevity in cancer. Ann. Surg., 1922, lxxvi, 9–12.
3. Martin, C. L., and Rogers, F. T. Intestinal reaction to erythema dose. Am. J. Roentgenol., 1923, x, 11.
4. Nakahara, Waro, and Murphy, J. B. X. The biological action of small doses of low frequency roentgen rays. J. Exper. Med., 1922, xxxv, 475–486.
5. Warren, S. L., and Whipple, G. H. II. A study of the sequence of clinical, anatomical, and histological changes following a unit dose of X-rays. J. Exper. Med., 1922, xxxv, 203–211.

AN EXPERIMENTAL STUDY OF RUPTURE OF THE UTERUS[1]

By JULIUS E. LACKNER, M.D., F.A.C.S., Chicago

A VAST amount of work on rupture of the uterus has been published during the past 50 years. A careful review of the literature reveals only a clinical study of the many etiological factors involved, the pathology, the mechanism, symptoms, and especially the treatment. The object of this paper is to present the findings of a series of experiments on rupture of the uterus in the lower animals, to determine the more exact etiological factors in the causation of this condition. It is obvious that human material is not available. The uteri of the lower animals are bicornuate, yet the histological structure and physiology are apparently analogous.

While these experiments are not completed, we feel that the data obtained is of sufficient interest to present in a preliminary report. This work has been in progress during the past year in association with Dr. S. S. Schochet.

The first series of experiments were conducted to determine if the type of incision in the uterus was a predisposing cause of rupture in a subsequent pregnancy.

The second series of experiments were designed to determine if the type of suture material played an etiological rôle in rupture of the uterus.

Only these two phases of rupture of the uterus are presented. The many other factors which we are working on will be discussed in a subsequent series of papers.

Thirty-two female goats were used in these experiments. We have found that the uterus of this animal is suitable for operative procedures and pressure determinations in this work. In order to understand more clearly the *modus operandi* of these experiments a brief description of the apparatus and materials is here given.

The apparatus (Fig. 1) consists of a pressure tank connected to a one-arm calibrated mercurial manometer by means of a calibrated Y-shaped connecting tube, the arm of which is connected with the uterus of the goat. A spring gauge is also attached to this manometer to estimate roughly the pressure levels in the mercurial arm. A second tube connects the mercurial manometer with a small glass bottle so as to control the various gas volumes in order that the recording pointer in the second calibrated U-shaped mercurial manometer will not record higher curves than the size of the smoked drum of the kymograph.

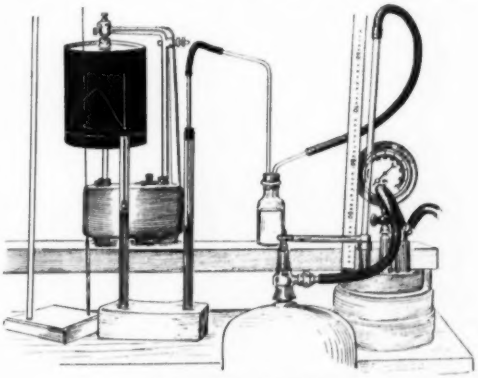

Fig. 1. The apparatus.

The apparatus, which appears of very simple construction, required several weeks for completion as we were not able at first to surmount the many difficulties encountered.

Read before the Chicago Gynecological Society, June 19, 1925. From the Research Laboratories of the Morris Nelson Memorial Institute for Medical Research, Michael Reese Hospital; and the Laboratory of Pathology, St. Bernard's Hotel Dieu. For discussion see p. 149.

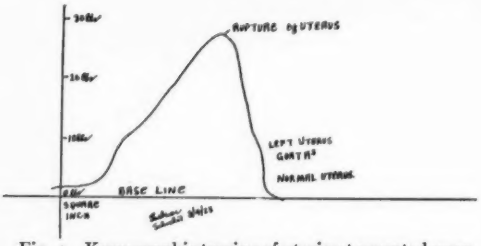

Fig. 2. Kymographic tracing of uteri not operated upon.

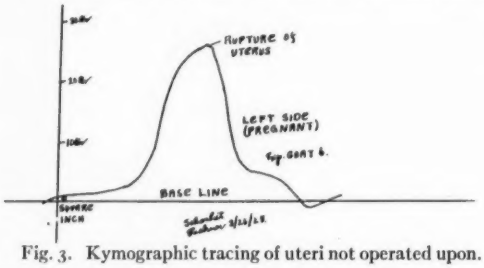

Fig. 3. Kymographic tracing of uteri not operated upon.

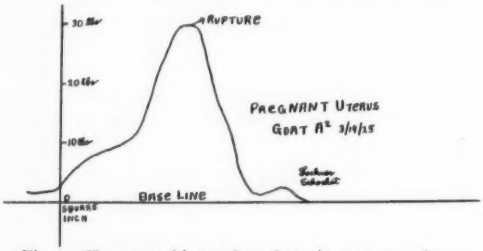

Fig. 4. Kymographic tracing of uteri not operated upon.

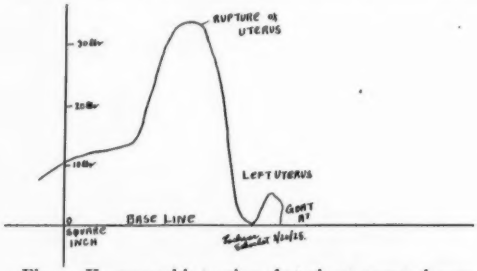

Fig. 5. Kymographic tracing of uteri not operated upon.

It is obvious that it is necessary to have this arrangement of apparatus to trace successfully pressures varying from zero to 35 pounds per square inch. The mathematical calculations, and the hydraulic and gas laws involved in obtaining the correct pressure will be presented by Dr. Schochet (see discussion, p. 149).

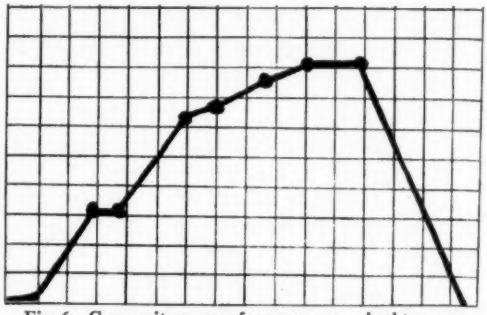

Fig. 6. Composite curve of pressures required to rupture normal uteri.

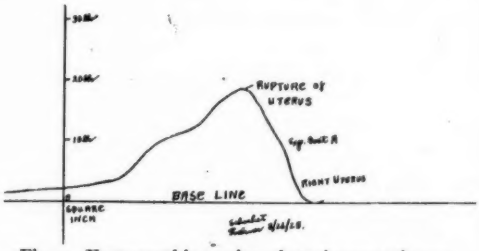

Fig. 7. Kymographic tracing of uteri operated upon.

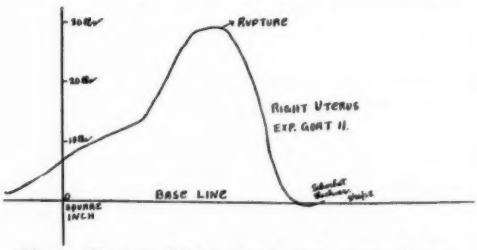

Fig. 8. Kymographic tracing of uteri operated upon.

The goats were operated upon under strict surgical aseptic conditions. The incisions were sutured with No. ∞ plain, chromic, and iodized catgut and the subsequent pressure readings on these uteri were made from 5 to 6 months after operations.

In order to determine whether the type of incision played an etiological rôle, it was necessary to determine the average normal pressure required to rupture the unoperated non-gravid uterus. The uteri of 7 goats were tested to determine the amount of pressure per square inch necessary to rupture the uterus. As shown in kymograph tracings, the pressures required to rupture a normal uterus

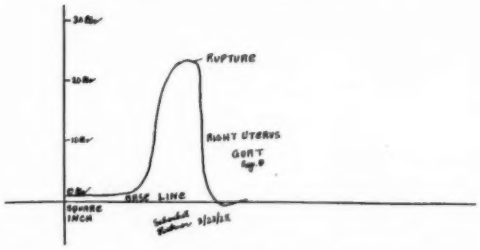

Fig. 9. Kymographic tracing of uteri operated upon.

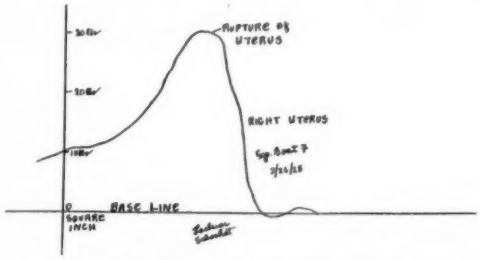

Fig. 10. Kymographic tracing of uteri operated upon.

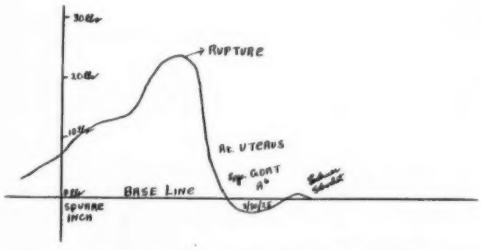

Fig. 11. Kymographic tracing of uteri operated upon.

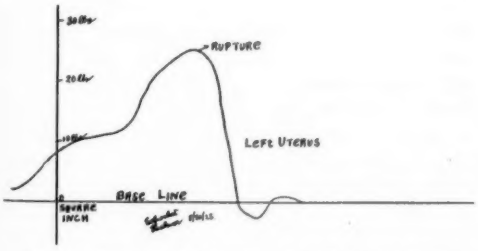

Fig. 12. Kymographic tracing of uteri operated upon.

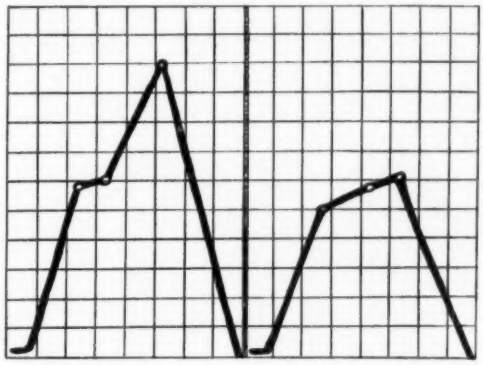

Fig. 13. Composite curve of rupture of uteri.

Fig. 14. Composite curve of rupture of uteri.

Fig. 15. Composite curve of rupture of uteri.

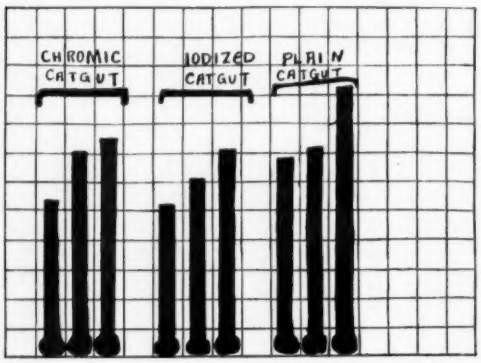

Fig. 16. Composite curve of pressures required to rupture uteri.

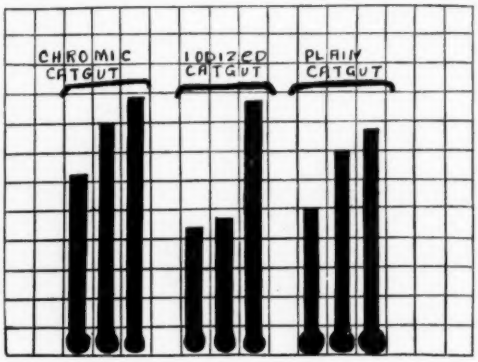

Fig. 17. Composite curve of pressures required to rupture uteri.

varied from 12 to 32 pounds per square inch (Figs. 2, 3, 4, and 5).

However, most of the uteri were ruptured by a pressure of more than 22 pounds per square inch.

Figure 6 is a composite curve of the pressures required to rupture the normal uterus. This curve was made by using the ordinates of the curves in Figures 2, 3, 4, and 5. The abscissa of the curves were not taken into consideration as this would include the factor of time, and the fracture or segmentation of muscle fibers which will be dealt with in another paper. With the establishment of this average pressure or norm required to rupture the uterus of a non-gravid goat not operated upon, we then proceeded to determine whether the type of incision and the type of catgut played etiological rôles in the rupture of the uterus. Three goats were operated upon under surgical aseptic conditions. One horn of the bicornuate uterus was incised transversely on its anterior median surface through the serosa, muscularis, and mucosa, and sutured with plain No. 00 catgut. The horn of the opposite side was incised longitudinally through the three coats and sutured with plain No. 00 catgut. The abdomen was closed. Three other goats were operated upon in a similar manner except that iodized No. 00 catgut was used. In the third group of 3 goats, similarly treated, chromic No. 00 catgut was used. The abdominal incisions of these goats healed by primary intention. We do not include in this group of 9 goats, those that had infected abdominal wounds or those dying from postoperative complications.

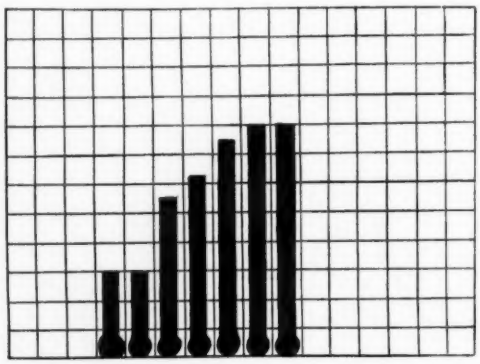

Fig. 18. Composite curve of pressures required to rupture uteri not operated upon.

At the end of 6 months, kymographic tracings were made to determine the pressure required to rupture the uteri of these goats that had been operated upon (Figures 7, 8, 9, 10, 11, and 12). These figures show the kymographic tracings of rupture from transversely and longitudinally incised uteri, sutured with plain No. 00 catgut. The pressures necessary to rupture the transversely incised uterus in which plain catgut was used (Fig. 13) were 29, 30, and 37 pounds per square inch; 22, 28, and 31 pounds in the longitudinally incised uteri. As seen in the composite ordinate curve of Figure 14, uteri incised transversely and

sutured with iodized catgut ruptured at pressures of 21, 24, and 30 pounds. The uteri incised longitudinally, ruptured at pressures of 18, 20, and 35 pounds. The transversely incised uteri which had been sutured with the chromic catgut ruptured at 21, 28, and 30 pounds pressure and the longitudinally incised uteri ruptured at 25, 32, and 35 pounds pressure (Fig. 15).

Figure 16 shows a comparative composite curve of pressures necessary to rupture uteri operated upon and incised transversely. A study of this graph shows comparatively very little difference with one exception. With the chromic catgut, the average pressure required to rupture the uterus was 26.3 pounds per square inch. With the iodized catgut, the average pressure was 25.3 pounds per square inch. With the plain catgut, the average pressure was 32 pounds per square inch. The higher average pressure obtained with plain catgut is due to the fact that the horn of one uterus required 37 pounds per square inch to rupture. We propose to make a later study of the connective tissue arrangement in the horn of this uterus.

Figure 17 shows a comparative composite curve or graph of pressures required to rupture uteri operated upon and incised longitudinally. The average pressure required with chromic No. 00 catgut was 30.6 pounds per square inch.

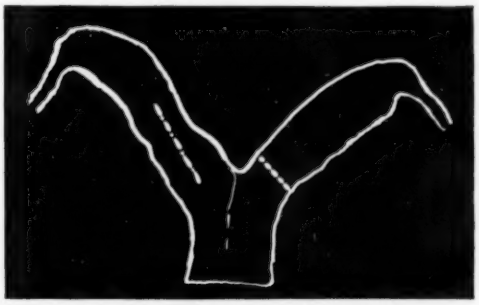

Fig. 19. Diagram to show location of incisions.

The average pressure with iodized No. 00 catgut was 26.3 pounds per square inch, and the average pressure with plain No. 00 catgut was 27 pounds per square inch. (Compare with Figure 18 of uteri not operated upon.)

If the pressures of the 9 longitudinally incised uteri with the three different types of catgut are averaged, we have a pressure of 27 pounds per square inch. Likewise, if the pressures of the 9 transversely incised uteri with the three different types of catgut are averaged, we have a pressure of 27 pounds per square inch.

CONCLUSIONS

The pressure required to rupture the uteri of goats operated upon is not affected by the type of incision or the character of catgut employed.

SOME COMMENTS ON THE TEACHING AND PRACTICE OF OBSTETRICS[1]

By W. GEORGE LEE, M.D., Chicago
Assistant Clinical Professor, Gynecology and Obstetrics, University of Chicago; Visiting Obstetrician, Cook County Hospital

IN the curricula of medical schools, the time assigned to the department of obstetrics is no more than that given many other departments dealing with phenomena restricted in occurrence, the duration of which extends over a far longer period and in which there is rarely any element of emergency. Moreover in this allotted time there are at present included many phases basically as closely allied to the medical and surgical field as to the obstetrical.

The abnormalities arising in pregnancy, of the type demanding attention in prenatal clinics, often require as wide a knowledge of essential medical technique as do labor and its problems; and the abnormalities seen in postnatal clinics demand surgical knowledge for proper interpretation and care. The importance of medical and surgical knowledge would justify the prevalent limitation of teaching time in the practice of obstetrics if that time allotted to this subject was utilized solely for making understood the phenomena peculiar to obstetrics, particularly those of labor. However, as much of the time is taken up now by the primarily medical and surgical phases, the students, in the time remaining, cannot obtain a grasp of the normal and pathological obstetrical phenomena and their rational management, because basically the physiological phenomena are complex and have a great admixture of mechanical elements, and these phenomena are dealt with by the obstetrical department alone.

Obstetrical teaching was the principal topic for discussion at a meeting of this society not long ago. What was the result? If what occurred is taken as an index, there was only a paucity of interest and an absence of ideas adjudged worthy of discussion. Indeed, the principal contribution was a laudation of one course of study in detail as already near the zenith of perfection. The inference seemed to be that there was little need for further search for improved methods. This was depressing, for this praised method of teaching obstetrics would appear to be just as capable of improvement as are the curricula and methods of most other medical schools, if judged by the product. Information from men in many institutions corroborates the diagnosis of widespread deficiency in obstetrical preparation, whatever the school concerned. The blame cannot be laid upon the students since they show a constantly higher standard of preliminary preparation and mental capacity, and so it must be placed upon the manner and methods of teaching.

Perhaps one difficulty may be that to many teachers, all facts seem to have equal value. The student burdened by the great multitude of obstetrical facts thrust into his charge, is like the overwrought hen trying to brood too many eggs with the result that few hatch because their number exceeds her capacity for keeping them warmed to a germinating temperature. Perhaps teaching departments have been expanded too rapidly, like hospitals, so that size has outrun organization and efficiency, or else like Topsy, they "just growed." Perhaps the members of other departments of medical teaching are not acquainted with, nor appreciative of, the needs for carrying on effectively this peculiar yet fundamental department of the science and art of medicine, and hence leave us inadequately supported.

More probably, however, it is the summation of many different causes, for which each individual member of this or similar societies, who call ourselves gynecologists and obstetricians, is in part to blame. It is true that not all of us are teachers in medical schools, but every one of us in this field of our especial interest should be an imparter of knowledge about it. We should be teachers of each other, and of those in other fields of medical practice; of internes trying to correlate earlier studies by the direct observation and care of actual patients with responsibility for them; of students laying foundations in the class-

[1]Read before the Chicago Gynecological Society, June 19, 1925. (For discussion, see p. 150.)

room, laboratory, and clinic; of nurses and social workers; as well as of the public at large. Teaching is of definite value to the one endeavoring to impart knowledge as well as to the recipient of the effort. Right methods aid so greatly that our own society would greatly benefit by conscious effort to discover and practice them. It would seem that most of us fail to question ourselves frequently enough about what we know, how availably we have our knowledge arranged, and how we can best utilize it. Too much of our time is used in trying to make understood, by words alone, novel and unshown phenomena. How many medical names mystify the student as well as the layman because in their experience there is nothing to which the strange word can be properly attached? Therefore to "show fully," or demonstrate, should come early and before discussion, that is, it should come before the "shaking apart" or analytic phase of teaching.

Oral presentation is of great benefit in that it enables emphasis to be placed on the varying value of facts and permits grouping them in new relationships so that old truths are seen in new vistas and acquire additional interest. Oral teaching should not supplant but should supplement and illuminate the printed word. Obstetrical texts exist in abundance, valuable for reference and often encyclopedic. Perhaps they are too voluminous for the classroom and too complex to be grasped by the beginner. Quiz compends also abound to reduce the beginner from the status of student to that of parrot. Is there not a need for handbooks or "introductions" that will broadly outline the topography of this division of medicine, correlate its outstanding features, give wide horizons, and form the framework which the individual may later elaborate from personal experience and study?

Why should we not standardize more of our technical vocabulary dealing with the definite phenomena and facts of obstetrics? Is it not strange that even here in our society it is often difficult to grasp the exact meaning of technical terms because their use is restricted to one or another teaching group? Why should anyone's vanity prevent the co-ordination of terms and definitions that please him with those used by others for like things? This society might well be a clearing house for this purpose and certainly students would benefit by having an authoritative list of such synonyms, as would we ourselves for teaching purposes. When there are several differing sets of terms for such basic facts as the relations in space between mother and fetus, of which the average student knows only the set preferred by his teacher, it is no wonder that misunderstanding results when he goes out from such instruction.

The graduates of all our schools seem to have learned lists of facts without having discussed their interrelationship or usuable value. Perhaps hypotheses are too often taught as if they were established beyond dispute. In the recent examination for Cook County interneship, the obstetrical questions were based upon a definite group of facts assembled to represent a clinical case. It was astonishing how many candidates used these clinical facts merely as a point of departure, springing immediately to some quiz class assemblage of data which they discussed extensively with no further interest in the governing conditions furnished.

I fear we teachers also are to blame in personal example. When a patient arrives at the Cook County Hospital in the third day of active labor, with a diagnosis of carcinoma of the cervix (later not confirmed by laboratory findings), with the membranes ruptured for 48 hours, with signs of fetal life not obtainable for at least 24 hours (the fetus being later found macerated) with only a 2 centimeter dilatation of the os, with a maternal pulse rate of 100 at entrance which continues to rise thereafter, and with the fetal presenting part still above the inlet, we may, I think, be justified in speaking of this as a neglected case. If such a case were received from the hands of a midwife or indeed from a general practitioner we would use it to illustrate oft-quoted evils, but she was received after being 3 days in the care of a well organized teaching dispensary.

Again when from another teaching clinic a patient is received after 24 hours in labor with membranes ruptured, but with the os still far from being completely dilated, with a history

of attempted operative delivery by forceps, although the presenting part is still above the inlet, when no valid reason for operative interference is found after her admittance except this unsuccessful invasion of the birth canal, and when she delivers herself spontaneously about 4 hours later with no indication for interference in the intervening time, should we be satisfied with our teaching? When a patient, after 3 previous deliveries cared for by midwives without noticeable disability resulting, passes through a teaching clinic from students upward, finally to emerge after laparotomy without her uterus, because a laceration in the introitus from an attempted forceps extraction had caused hæmorrhage and dismay, should not each of us become diligent in acute observation and analysis, confer about possible improvement, and cease throwing stones at those who conscientiously question dictums, who want to be shown the validity of new methods before abandoning time tested ones? When recent graduates have frequent unattended births, "precipitate labors" as they delight to call them, because they cannot or do not judge aright the rate of progress in cases relatively normal in all factors, who show much greater familiarity with infrequently needed procedures of still disputed worth than with the simple maneuvers almost constantly required, does it not behoove all of us to look for adequate correctives for such faulty results?

THE PRACTICE OF OBSTETRICS

The obstetrical division of the Cook County Hospital has 4 visiting staff members, each of whom teaches in a different medical school. The service of the house obstetricians is relatively short and there are several different ranks in varying parts of the division, but without continuity. These house obstetricians, coming from various schools, use different nomenclature and obstetrical procedures. Their services do not overlap so that there is little opportunity to secure continuing uniformity of technique. One result of this is that the records do not lend themselves well to statistical use.

During the residency of Dr. J. H. Gernon from January 1 to July 1, 1924, we attempted to tabulate and analyze all cases of interest. These were culled from a total of 1,268 maternity cases, of which 1,008 were in Ward 51, 176 were in Ward 50, and 71 were from the venereal segregation ward. In addition there were 13 cases of cæsarean section, which will be reported later by our fellow member Dr. Henry F. Lewis, who is making a detailed study over a much longer time.

Before taking up the results of this analysis let me present a tabulation derived largely from statistics obtained from the department of health of the City of Chicago, of which Dr. Herman N. Bundesen is commissioner. These statistics were from a survey of Chicago hospitals, instituted by Commissioner Bundesen's advisory committee of prenatal activities. These statistics showed the number of spontaneous and operative deliveries cared for by each hospital during the year 1923. The present tabulation consists of those figures reduced to the rate per 1,000 to afford a better comparison. Only seven hospitals are cited, chosen both because of the number of patients they cared for and because their obstetrical services are distinct. All seven hospitals are represented in this society. The sum total of all the 74 hospitals included in this survey was reduced to the same basis and added. Our cases at Cook County Hospital have been reduced to the same scale and appended to this tabulation.

NORMAL AND OPERATIVE DELIVERIES IN HOSPITALS

Figures = Number per 1,000 Cases

Spontaneous	Forceps Low Extraction	Forceps High Extraction	Cæsarean	Version	Extraction	Breech Interfer.	Destructive
953†	13	3	8	4	4	15	½
763	163	10	26	12	12	10	2
764	184	0	10	20	0	16	4
845	104	13	10	14	12	0	2
837	107	13	13	6	18	5	1
741	174	0	19	20	20	25	0
766	135	0	42	2	15	39	2
761	146	34	19	11	12	14	3
905‡	30	7	11	28	*	15	4

†Health Department figures.
‡Our service.
*All versions were followed by extraction.

We realize that the figures in our table give very limited information. The number of spontaneous births in 4 hospitals substantially agree. The rates above the average of spontaneous births at Cook County Hospital,

shown on the top and bottom lines may probably be explained by the fact that the women were largely of the European peasant type.

The operative births show variations somewhat dependent upon the personal point of view of the staffs. In low forceps cases the rates vary, the lowest rates being in those hospitals with the greatest number of spontaneous births. This may be due to more rigid indications for interference. Certainly in the Cook County Hospital, we believe that the number of such deliveries might well be considerably increased if the progress of labor were more closely followed and the obstetrical acumen of the house staff had been sharpened by more efficient preparation. In this tabulation low forceps include also the mid or median type and we regret that this division cannot be shown, for it is our belief that true low forceps (outlet forceps with complete internal rotation) imposes far less strain upon the patient than mid-forceps in which internal rotation is not as yet completed. The returns for delivery by high forceps show three hospitals in which this operation apparently is taboo, three other hospitals with close agreement in rate, while the Cook County Hospital has a still lower record. The rate from the sum total of the 74 hospitals shows such a marked increase over any of these seven that our interpretation would be that the station of the head was not well known in many cases; in other words that difficult mid-forceps may have been included in the high forceps classification. The cæsarean section rates show three hospitals with rates far above the other four; and the lowest rate is in exact agreement with the average from the total 74 hospitals. The highest rate occurs in that hospital with the smallest number of other methods used for delivery when the presenting part is still above the inlet. In version, two hospitals are markedly above the others in rate as well as above the average of the 74 hospitals, and our appended figures for the series we are reporting is the highest of all. The rates of the seven hospitals based upon the total number of high forceps, cæsarean section, version, and extraction cases vary very little.

Three hospitals show the same number of extractions and versions, which is what we would expect. One hospital shows no extractions following versions, while two hospitals show such an increased number of extractions that our interpretation is that the questionnaire was misunderstood, for these same hospitals show a correspondingly decreased rate of breech interferences. The rates for breech interferences show that in the smaller hospitals there must be less hesitation in interfering with spontaneous progress. Destructive operation rates show two hospitals that exceed the general rate of all 74. When we remember that these 74 hospitals include a large number absolutely forbidding destructive operations unless the fetus be assuredly dead, it would seem that some explanation should be forthcoming to account for this high rate. In one of these hospitals no high forceps were used; perhaps this is the explanation of the increased number of destructive operations. The other high rate occurs in our series and later will be considered in detail.

We now come to our particular series and it may be of interest to show the basis of our analysis.

SCHEME USED TO ARRIVE AT FIGURES SHOWN IN TABLE

Service.....
Name.....

PREGNANCY

Date delivered.....
Race.....
Duration.....Para.....
Pelvic measurements
  Interspinal.....
  Intercristal.....
  Intertrochanteric.....
  External conjugate.....
  Diagonal conjugate.....
Type of pelvis and degree of disproportion.....
Presenting part.....
Position.....
Station.....
Systemic complications, i.e., cardiac toxæmia, etc.....

LABOR

If onset induced, method.....
Character of uterine contractions
  First stage.....
  Second stage.....
Duration
  First stage.....
  Second stage.....
  Third stage.....
  Total.....

Placental birth
- Spontaneous.....
- Expression.....
- Manual removal.....

Subsequent uterine treatment.....
.....

Laceration or episiotomy
- Repair.....
- Result.....

COMPLICATIONS OF LABOR

Lack of progress.....
Stage of delay.....
- Inertia of uterus
- Rigid cervix.....
- Bag of waters unruptured after first stage.....
- Bag of waters ruptured early first stage.....
- Dry labor.....
- Oligohydramnios.....
- Polyhydramnios.....
- Constriction ring.....
- Abnormal presentation.....

Threatened rupture of uterus.....
Maternal hæmorrhage
- Antepartum.....
- Intrapartum.....
- Postpartum.....

Signs of exhaustion
- In mother
  - Uterus.....
  - Pulse.....
- In fetus
  - Meconium.....
  - Heart tones.....
  - Caput succedaneum.....

Forelying funis.....
Prolapse of funis.....

OPERATIVE DELIVERY

Hours in labor.....
Clinical—Stage of interference.....
Condition of cervix.....
Dilatation of os.....
State of bag of waters.....
Station of presenting part.....
Operation preparatory to extraction.....
Delivery operative method.....
Anæsthetic used and duration.....
- Immediate maternal result.....
- Remote maternal result.....

CHILD

Cord about neck.....
Short cord.....
Asphyxia
- Livid.....
- Pallid.....

Resuscitation method.....
Injury or deformity.....
- Final result.....

Sex.....
Weight.....

REMARKS ON PUERPERIUM

.....
.....
.....

The arrangement shown in our schema has proved of great interest to us and we suggest its careful consideration by others. If in each hospital a summary of all labors were entered on such a form, as soon as each labor was finished; and particularly if the different varieties of delivery were separated and on distinct sheets, a mine of information would be quickly amassed having great worth, especially if the terms therein were standardized so that they represented like things.

Out of the 1,268 cases already mentioned, 22 were delivered by low forceps, 15 by mid-forceps and 9 by high forceps, 35 by version and extraction. There were 20 breech presentations in which manual extraction was done. There were 15 breech presentations in which some manual aid was given and 1 in which birth was completely spontaneous. There were 6 pubiotomies done, 5 destructive operations on the offspring, and 13 cæsarean sections. Of 8 pairs of twins, one pair required operative delivery. There were 86 protracted labors of over 24 hours' duration, but with spontaneous birth.

The 122 operative interferences give a percentage of 9.5 which coincides with the tabulation rate already made in comparison with the other hospitals; 67 (5 per cent of the total) were of serious nature. In the protracted yet spontaneous labors numbering 86 cases, 58 were in primiparæ, in 55 the fetus was in occiput left anterior position, in 11 the pelves were justo minor in type, in 1 justo major, in 7 flat, and in 2 there was high blood pressure. There were 3 cases of lues, in 2 of which the fetus was macerated. Among the abnormal conditions were 84 cases of delay in the first stage and 2 in the second stage; delay occurred in 53, with the head distinctly high. The cause of delay in 47 cases was inertia, in 9 cases, signs of maternal exhaustion as indicated by rising maternal pulse. There were rigid cervices in 4 cases, dry labors in 15, rupture of the bag of waters early in the first stage in 9, and oligohydramnios in 14. Four babies showed marked caput succedaneum. Four episiotomies were done and there was one tear of the second degree. There were 2 cases of artificial rupture of the bag of waters, 1 of dilatation by hydrostatic bag, and 1 of

manual rotation. In 11 cases scopolamine-morphine was given to banish memory, in 6 small doses of morphine during the labor, and in 1 digitalis. (We would call particular attention to the number of cases of oligohydramnios because we have found this condition a fertile source of delay. In our opinion it exceeds dry labor in importance because it has received scant attention and therefore is rarely diagnosed although it results in the same difficulties that dry labor may cause.) Of 2 cases delivered spontaneously, 1 was admitted after attempted delivery by high forceps outside. The pelvis was flat in type and the maternal pulse rather high; and the head was already well advanced. The baby died in 6 days from a depressed skull fracture which was elevated after birth. The other patient came in in active labor, with a face presentation and near the end of the first stage. The face was converted to a vertex and the birth of a 10 pound baby in good condition occurred without further delay. In several cases the labor was of considerable duration. The only reasonable explanation is that the condition of both mother and child remained good throughout, for no fetal or maternal deaths resulted. I may here note that all scopolamine-morphine cases reported are from one service.

Low forceps cases in this series are those in which internal rotation was complete, so that the obstacle to progress was either bony or soft tissue of the outlet. One of these low forceps was secondary to pubiotomy. Of the 21 primary low forceps, 15 were in primiparæ. All had complete effacement and dilatation of the os, and there were no fetal deaths. The one maternal death in the series resulted from spinal anæsthesia and the delivery of the child by forceps was done only because and after the mother was *in extremis*. Other factors of interest cited in the records are: no co-operation of the patient, 1; rigid perineum, 3; high blood pressure, 1; cardiac pathology, 1; pelvis, flat in type, 1; and justominor, 1. In all cases there was second stage delay. In addition, 1 prolapsed arm and 1 manual rotation received necessary preliminary treatment. There was one case in which the occiput was posterior from mal-rotation. The cases showing inertia were 2; early rupture of the membranes, 2; dry labor, 2; oligohydramnios, 2; postpartum hæmorrhage, 2; signs of maternal exhaustion, 11; of fetal exhaustion, 4; 8 episiotomies were done and there were 5 first degree tears.

Of the 15 mid-forceps cases 1 was secondary to pubiotomy. In all of the 14 cases of primary mid-forceps, the cervix was effaced, but in 2 dilatation of the os was not complete when interference was started. Of the 14, 13 were primiparæ; there was 1 cardiac case, 1 complicated by dermoid cyst, and 1 by multiple fibroids. One was the first of twins. There were 3 deep arrests; 2 had justominor pelves.

Complications in labor: There were no inertia cases, no dry labors, in 3 the membranes ruptured early in the first stage, in 5 oligohydramnios was present. Signs of maternal exhaustion occurred in 11, of fetal exhaustion in 2. One episiotomy was done, in 3 cases there were first degree tears and in 2 second degree tears. The average duration of the low forceps cases was 18 hours first stage, 2 hours 20 minutes second stage, 20 minutes third stage. The average duration of the mid-forceps cases was 21 hours first stage, 2 hours 12 minutes second stage, 16 minutes third stage. To bring together the less serious interferences and the spontaneous abnormal cases, we will add 16 breech presentations. In 1 breech case with spontaneous delivery and a macerated fetus, toxæmia developed. Of 15 breech cases receiving some assistance, 10 were primiparæ, 5 cases were of the footling variety, and in 2 of the cases the babes were macerated.

We now come to that 5 per cent of serious interferences. There were 9 high forceps deliveries, 1 secondary to pubiotomy. Of the 8 primary high forceps cases, 1 was a primipara, 1 was a "neglected" brow with an undiagnosed papyraceous twin weighing about 2½ pounds. In 3 the pelvis was flat in type, in 2, there was delay in both first and second stages, in 5 cases in the first stage, and in 1 case in the second. Inertia was present in 2, dry labor in 2, oligohydramnios in 4, polyhydramnios in 1. Postpartum hæmorrhage needing subsequent intrauterine packing occurred in 2, signs of maternal exhaustion in 5, and of fetal exhaus-

tion in 2; 2 episiotomies were done, and in 2 there were first degree tears. Apart from the neglected case, 2 fetal deaths resulted. One was a 12 pound baby, and 20 minutes were lost in delivering the shoulders; the other was an 8 pound baby delivered with occiput posterior. The mother had received scopolamine-morphine anæsthesia and had worn an abdominal belt for 2½ hours to assist expulsive efforts. Inasmuch as the case of neglect resulted in maternal death in 7 days from general peritonitis, and in the baby's death in 2 days and delivery was by the author, further details are given. After 30 hours' labor in an outside teaching clinic, the patient was admitted to Cook County Hospital upon another service, where she received scopolamine-morphine anæsthesia for 7 hours. At this time I was asked to see the case. The presentation was longitudinal, but the presenting part supposedly vertex was found to be a brow presentation. The uterus had been dry on admission. At this time there was complete effacement of the cervix but a dilatation of only 4 centimeters. Manual dilatation preceded the conversion of the brow to a face, for the retraction of the uterus prevented successful extension of the head. A very slow extraction was done thereafter, for our belief is that the real impediment to fetal exit from the uterus could be safely overcome only by tiring out the constriction ring. After this tedious part was accomplished, extraction through the bony pelvis occurred without incident. The papyraceous twin was delivered 20 minutes later in an intact and distinct sack. The fetal head was markedly molded from its long stay as a brow; but only livid asphyxia was present. The postmortem examination of the mother disclosed no injury of the uterine walls.

There were 35 cases of version followed by manual extraction; 13 of these patients were primiparæ, 19 multiparæ, 3 unspecified. There were 6 cases of antepartum bleeding, 3 from placenta prævia marginalis, 1 from placenta prævia centralis, 1 from ablatio placentæ, and 1 from cervical laceration. In one of the cases of placenta prævia marginalis in which the pelvis was of the justominor type, the fetus presented transversely with a prolapsed hand. There were 7 other transverse presentations; 2 with a prolapsed arm, and 1 with a prolapsed cord. There were 2 cases with brow presentation, 1 case of toxæmia, 1 of eclampsia, and 1 with signs of maternal exhaustion. One was the second twin. Two pelves were justominor in type and 3 were flat.

The complications of labor include 4 cases of inertia, 2 dry labors, 3 cases of early first stage rupture of the membranes, and 2 of constriction rings. In 5 there was threatened uterine rupture.

The method of treating the antepartum hæmorrhage varied, although all were first stage interferences. In 2 cases of placenta prævia marginalis the bag was inserted and 1 live baby delivered. In 2 cases of Braxton-Hicks version, 1 baby survived, but in the other, a case of placenta prævia centralis, the baby died. In the 1 case of ablatio placentæ a bag and a Spanish windlass were used, and the baby was dead. In 1 case in which the bag and manual dilatation of the cervix were used, the baby was macerated. Of all other cases in the series, 2 babies died in 2 days, 1 baby died in 4 days, 1 baby was macerated, and 1 baby (in the eclamptic case) was dead when received. Three placentæ were manually removed.

We think it only fair to discuss the reason for this large percentage of version and extraction cases actually 35 in number, because out of these 35 cases, 21 are chargeable to one service, the remaining 14 being distributed as equally as possible among the other three services. Twenty of the total number of cases show the classical reasons for interference. Of the remaining 15, all on one service, the reasons for version are not very clear from the records unless one postulates a predilection for this method of delivery. In all of the 15 cases there was skull presentation, in 11 a posterior position of the occiput, in 2 inertia, in 8 ruptured membranes, in 1 a dry labor with a constriction ring after an initial polyhydramnios and here interference was instituted after 56 hours of labor. The mother was in poor condition after delivery but recovered; the baby was one of those who died in 2 days. In 6 of these 15 interferences, manual dilatation before version was done in the first stage. We believe we are not misrepresenting conditions

when we state that the one service in which this last group occurred is headed by an avowed admirer of Potter; and in addition we may say, that on this same service were all the cases receiving scopolomine-morphine, or twilight sleep, as well as all pubiotomies, but one. There the resident in an emergency elected to follow this method. This should be borne in mind when the pubiotomies are analyzed.

The primary manual extractions, which occurred in 20 breech cases, show the following items of interest. There were 6 footling extractions; in 2 cases there was a prolapse of the cord; and in 14 cases, breech presentation, one with prolapse of the cord. There were 10 primiparæ and 10 multiparæ, 2 toxæmia cases, 2 dead fetuses with heart tones not having been heard during the labor, 1 case of intrapartum hæmorrhage from ablatio placentæ occurring before entrance to the hospital, 1 of postpartum hæmorrhage; in 5 cases there were signs of maternal exhaustion, in 1 of fetal; there was 1 case of inertia, 1 with early rupture of the bag of waters. Of the other 3 dead babies, 1 death was the result of ablatio placentæ, 1 the result of marked delay in getting down the feet, 1 was a case of pallid asphyxia with a cleft palate, as already mentioned, in 2 no heart tones were heard at any time in the hospital, 1 fetus being macerated. There was 1 manual removal of the placenta. The most severe of these cases from the maternal standpoint was the one of ablatio placentæ. This patient was received in very poor condition, but recovered.

Pubiotomy was performed in 6 cases, in 2 before the approach of labor. One of the 2 patients was afflicted with tertiary lues; in the other, the pelvic measurements in centimeters were: interspinal, 21.5; intercristal, 23; intertrochanteric, 27.5; external conjugate, 18; transverse conjugate, 11.5. She had an easy and rapid delivery of a 5 pound, 14 ounce baby. In the other case of spontaneous delivery the pelvic measurements were: interspinal, 22; intercristal, 24; intertrochanteric, 31; external conjugate, 19. The weight of the baby was 5 pounds, 3 ounces. All 3 of these patients were primiparæ. In the fourth pubiotomy, the measurements were 22, 26, 30, and 19; the patient was a ii-para; the baby weighed 5 pounds, 10 ounces, and required mid-forceps to complete delivery. The fifth was also a ii-para, with measurements of 22, 23, 29, 18.5 and diagonal conjugate of 11 centimeters. The baby weighed 6 pounds; pubiotomy was done about 9 hours after the onset of labor and the baby was delivered by high forceps 7 hours later. This patient had scopolomine-morphine.

The emergency case in which pubiotomy was done, was a iii-para who was brought to the hospital after 24 hours of labor, with face presentation and fetus high in station. The diastolic blood pressure was 185; systolic, 130. There were present marked œdema, respiratory infection, and a "toxic adenoma." The measurements were 25, 28, 29, 18, and 10. Under ether the face presentation was converted to a vertex, and then a high forceps extraction was attempted. After ¼ grain morphine had been given, and the patient had rested for 3 hours, a pubiotomy was done. Low forceps were used for final delivery. A 6 pound child was born in pallid asphyxia, but neither mother nor child survived long.

The destructive operations numbered 5 in this series, with one maternal death. The death occurred in a primipara with a breech presentation, and a true conjugate of 10.5 centimeters. She was suffering from eclampsia, hypertension, nephritis, cardiac decompensation, and very marked obesity. No fetal heart tones were obtainable. She was admitted after having been in labor almost 2 days and in very serious condition. At the time of interference marked signs of maternal exhaustion were present. The os was incompletely dilated; therefore a preliminary dilatation by a Voorhees bag was followed by manual dilatation. Embryotomy was followed by craniotomy done on the after coming head. The mother died 4 days later.

The other 4 destructive operations were done by the writer. Three were craniotomies, one done upon a hydrocephalic baby from whose head 500 cubic centimeters of fluid was obtained after 42 hours' labor in the care of a midwife. This case showed signs of threatened rupture of the uterus, a Bandl's ring being apparent. There were signs of maternal exhaustion, the pulse being 130 when patient was

admitted. Maternal recovery was uneventful. The other 2 cases of craniotomy followed tentative traction by high forceps. One was a case of dry labor, with signs of maternal and fetal exhaustion. The first stage of labor had lasted 68 hours with a dilatation of the os of only 5 centimeters. She was a vi-para, with measurements of 26, 28, 30, 17.5 and a true conjugate of 11.5 centimeters. The fetal head was unmoldable from excessive ossification. Craniotomy resulted in maternal convalescence without incident. The remaining craniotomy was done after labor had lasted 37 hours, the head was still high, and the fetal heart tones had disappeared. Maternal recovery was uneventful, although the pulse was 110 at the time of interference.

All these cases may be fairly called neglected, being received in very bad condition. The final case must also be so classified, although the neglect was in part ours. Faulty diagnosis of the presentation resulted from too long use of rectal examination alone. This was a primipara with normal measurements, having an active gonococcal infection as well as a pronounced growth of condylomata around the whole introitus. A diagnosis of footling presentation was made by rectal examination. Early rupture of the membranes had occurred before entrance into the hospital. Lack of progress for 14 hours thereafter with a rising fetal heart rate finally resulted in a vaginal examination, and at this time the true diagnosis was made of a transverse presentation with a hand over the os. When I saw the case, the uterus was tightly retracted upon the fetus, and the fetal heart tones were abnormally high. A decapitation was followed by a craniotomy. The weight of the parts of this baby after delivery was 8 pounds. The mother had an uneventful convalescence.

CONCLUSION

In conclusion I would call attention again to the fact that at Cook County Hospital we have to receive patients in every stage of labor, no matter how serious the condition, and that the total number of neglected cases forms a very considerable factor in our operative results, and to point out as well that no control is possible over individual practices of the attending staff on the different services. Under such conditions we think that this analysis and the results shown will conclusively refute the popular belief formerly so wide-spread, that at the Cook County Hospital operative interference is often done without proper indication and is resorted to vastly more frequently than in hospitals under private control. We think that this report shows convincingly that, as a whole, the Cook County services are decidedly conservative and that in general, the indications for major operations are definite and valid.

ROENTGENOGRAPHIC DIAGNOSIS IN GYNECOLOGY; PNEUMOPERITONEUM[1]

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From the Adolph Stein Memorial for Research in Roentgenology

ALTHOUGH it is 13 years since Weber and Lorey independently described the adaptability of the abdominal viscera to roentgenography after pneumoperitoneum, and although Orndoff, Stein and Stewart, Alvarez, and many others have made valuable contributions to the perfection and scope of the method, the gynecologist is still skeptical as to the value of roentgenography in his work. The reason for this is that the soft genital organs are not generally thought of as being adaptable to roentgenographic diagnosis and therefore little attention has been given this subject. The size and shape of the pelvic viscera and their relationships, their varying densities and organ outlines are the factors of diagnostic importance. These points can be brought out on the roentgen film under certain favorable conditions.

Before taking up a relatively new method of diagnosis the careful physician might well ask himself the following questions: Can the internal genitalia be clearly and accurately outlined on the roentgen film? Is the roentgen film of any value in addition to the clinical and other laboratory findings? Is the procedure harmful to the patient? Can any gynecological condition be thus recognized that may escape recognition with the usual diagnostic means? Should roentgenography be employed routinely in gynecological diagnosis?

These questions can best be answered by citing cases in point, and will be treated in the conclusions.

The gynecologist arrives at a diagnosis usually after careful history taking, a bimanual vaginal and rectal examination, and inspection of the vagina and cervix through the speculum. He utilizes smears, cultures and serological tests, the sound, and the cystoscope as his judgment dictates. In spite of care and skill, errors in gynecological diagnosis are so common that the physician welcomes any new method of precision which can be safely used to reduce errors to the minimum. The fact that extra skill and time are required of the physician and that it imposes additional expense upon the patient should not exclude a method which possesses merit. Roentgenographic diagnosis is one of the newer methods of the past 5 or 6 years which enhances accurate diagnosis in gynecology but which is not commonly utilized for this purpose. To Reuben Peterson belongs great credit for clearly demonstrating the practical adaptation of this diagnostic method to gynecology. Working with the late Dr. Van Zwaluwenberg in Ann Arbor he utilized the partial knee-chest posture (Fig. 1) for obtaining accurate optical cross-sections of the pelvic organs on the roentgen film, and reported a series of 300 cases to the American Gynecological Society in 1921. He also recommended the utilization of Rubin's patency test for transuterine inflation of the abdomen in suitable cases.

Following the Peterson technique I have made use of roentgenography in my gynecological diagnostic work in the past 2 years with so great a degree of satisfaction that I desire to emphasize some of its advantages.

In this field of diagnosis, as Peterson brought out, team work is requisite for success. Neither the roentgenologist nor the gynecologist working alone can achieve the results that are obtained by their co-operation. I have utilized carbon dioxide through the Rubin patency test apparatus for inducing abdominal inflation both by transuterine and transabdominal routes. About a litre of gas is usually introduced. This method was used in over 150 consecutive patients with no accidents or untoward results. The only complaint from our patients was the "shoulder pain" which often distressed them a few days, but which could be relieved by assuming the recumbent posture.

We again followed Peterson in the plan of study of our cases, namely, a provisional diagnosis was made after the usual gynecological examination, then pneumoperitoneum was

Read before the Chicago Gynecological Society, June 19, 1925.

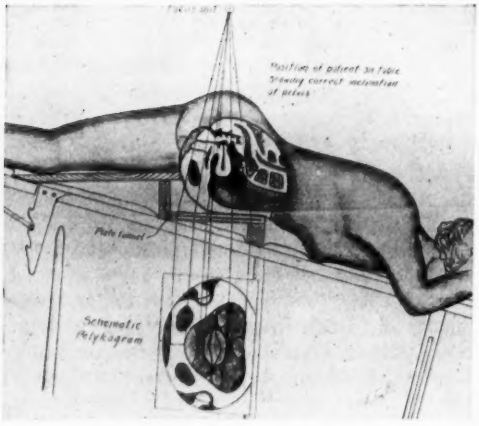

Fig. 1. Partial knee-chest posture for pelvic roentgenography after pneumoperitoneum. (From Peterson.)

induced upon the X-ray table, the partial knee-chest posture was arranged, and stereoroentgenograms were made. A diagnosis was made independently by the roentgenologist from the roentgenographic evidence alone. After a joint study and discussion of the films, the clinical and roentgenological evidence was correlated. In the operative cases the diagnosis was finally checked up when the abdomen was open. The interpretation of the films was indeed the most difficult part of the investigation, and we confess to many errors in our early diagnoses. With greater experience we are becoming more familiar with the roentgen aspect of pelvic conditions, and we are often surprised at how readily we now recognize certain pathological conditions, and how much oftener we agree.

By using the Potter-Bucky diaphragm we have obtained even greater detail than did Peterson, and in addition to the uterus and ovaries, we visualized in some cases the normal fallopian tubes, round and broad ligaments, bladder and adhesions.

The following conditions have been compiled from our pneumoperitoneal diagnoses:

	Cases
Normal genital status	12
Hypoplastic uterus	2
Immature uterus	2
Bicornuate uterus	1
Uterus duplex	1
Displaced uterus	7
Ventrally fixed uterus	2
Early pregnancy	10
Ectopic pregnancy	2
Pseudocyesis	2
Fibroids	8
Ovarian cyst	13
Papillory cystadenoma of ovaries (malignant)	1
Tubo-oophoritis	5
Chronic salpingitis	6
Frozen pelvis	1
Adhesions	24

We failed to obtain diagnostic films in 2 cases because the gas was injected subperitoneally, wholly or partially. These were in

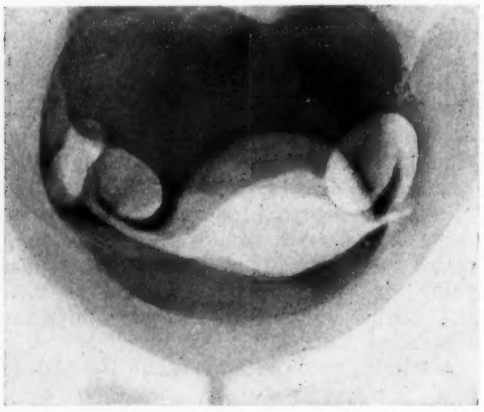

Fig. 2, a. Drawing showing normal genital status in patency test for sterility.

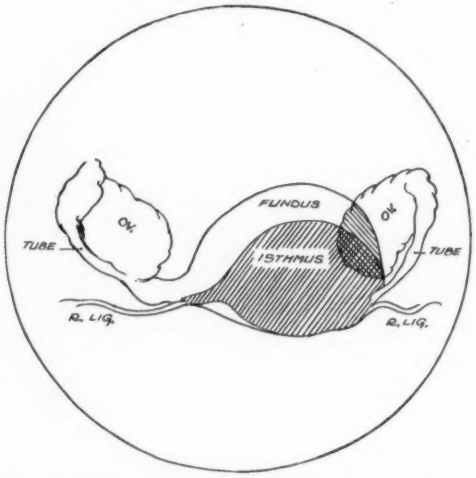

Fig. 2, b. Diagram of Figure 2, a, showing normal genital status in patency test for sterility.

badly behaved subjects. Some films were of no value because of radiological technical errors. The technique had to be evolved.

To emphasize the value and usefulness of roentgenography after pneumoperitoneum, the following cases from the above list, with illustrations, are reported.

CASE 1, Fig. 2, reveals a normal genital status obtained after performance of the patency test in a case of sterility of 12 years. This illustrates that great detail is obtainable by this method of roentgenography. The uterus, fundus, and isthmus in cross-section, ovaries, tubes and round ligaments are clearly seen.

CASE 2. In contrast to the first case, the normal genitalia of a girl of 13 years are depicted in Fig. 3 in whom transabdominal pneumoperitoneum was performed to disprove a suspicion of pregnancy. The first menstruation occurred May, 1923. After three regular periods she skipped three periods. The family physician thought that she was pregnant and brought her to us for a verification of his diagnosis. The size of the uterine shadow and absence of Peterson's sign of early pregnancy indicated that she was not pregnant. The negative finding in this instance has great diagnostic value aside from the immeasurable mental relief to the parents. Rectal examination would not reveal the condition with the same degree of positiveness.

CASE 3, Fig. 4, depicts the pelvis of a patient admitted to the hospital with the clinical diagnosis of fibroids. She complained of metrorrhagia and pelvic pain. Two previous operations had been performed, one for "pus tubes" and the second for

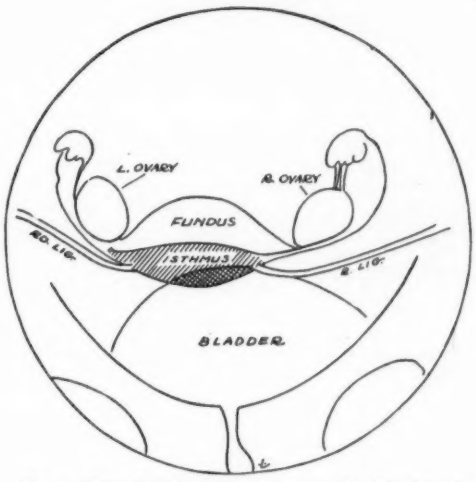

Fig. 3. Normal genital status, 13 year old girl. Question of pregnancy settled definitely in the negative by the film evidence.

ovarian resection. Palpation revealed a firm mass in the entire pelvis, a tender uterine fundus in Douglas' cul-de-sac adherent to the mass. Laparotomy revealed conditions just as depicted in the roentgen film, namely, large left and smaller right ovarian cyst, retroverted uterus and adhesions. Total hysterectomy and double oöphorectomy were performed.

CASE 4, Fig. 5, depicts the findings in another patient in whom transabdominal inflation was per-

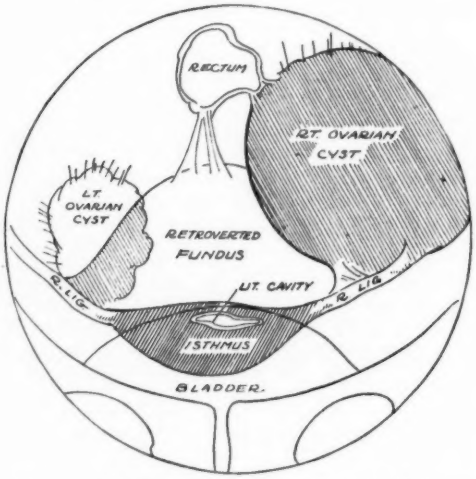

Fig. 4. Bilateral ovarian cysts; retroverted uterus. Adhesions.

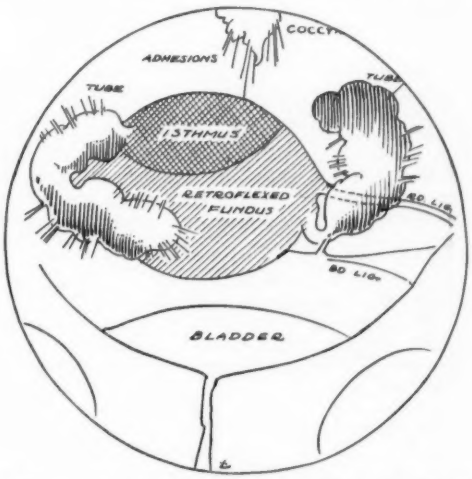

Fig. 5. Chronic salpingitis with adhesions; retroflexed uterus.

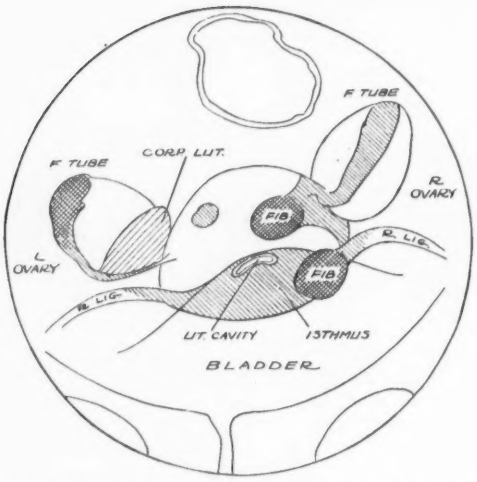

Fig. 6. Multiple fibroids; retained ovular tissue. Clinical picture of ectopic pregnancy. Tubes definitely normal in film.

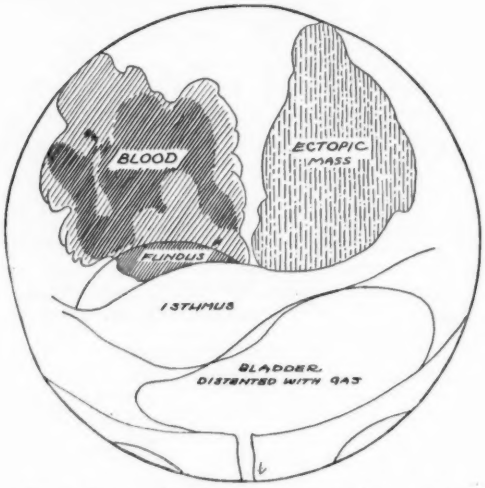

Fig. 7. Ruptured ectopic pregnancy. Patient very obese. History and physical findings confusing. Film diagnostic.

formed. She was a nurse, age 29, single, and complained of pelvic pain. There was no history of a previous inflammatory process. Examination revealed a firmly fixed retroflexed uterus, adherent to bilateral pelvic masses which were firm and tender. The clinical picture was not that of an acute process. The films clearly reveal bilateral tubal swellings and an apparently enlarged adherent uterus. The magnification of the uterine shadow is produced by its retroposition, having been considerably farther from the film than normal. Salpingectomy and Gilliam's round ligament suspension of the uterus were performed.

CASE 5, Fig. 6. This patient was a young woman, age 26 years, who had one child 5 years ago, with an uneventful interval history until the present complaint. Her last menstrual period was 9 weeks ago. She felt well until 2 weeks ago—3 weeks after the missed period—when she began to bleed. This was at first just a spotting, and it was accompanied twice by fainting. Pain had not been severe, but there was a constant low backache and some left sided abdominal pain. Upon examination the uterus was found to be erect, slightly enlarged and softer than normal, irregular in consistency, and the left adnexa extremely tender, soft, but not palpably enlarged. Palpation was made very gently to avoid rupture. When the patient was informed that the impression was that of an ectopic pregnancy, she informed me that she had been to two obstetricians previously and that both had diagnosed the same condition. She wanted to know how one could be more positive however, before submitting to surgical exploration, consequently transabdominal pneumoperitoneum was induced and pelvic roentgenograms made. The interpretation of these films was by no means simple, for although the uterus and both adnexa show clearly on the films, only by studying them stereoscopically did we come to the diagnosis of uterine fibroids, and probable normal adnexa. In view of the acuteness of the disturbance, however, and the previous opinions rendered it was deemed advisable to explore the pelvis. At operation the adnexa were found entirely normal. The left ovary contained a recent corpus luteum. The uterus was enlarged and contained several intramural fibroids from 1 to 2 centimeters in diameter which were removed. One seemed to be submucous and in an attempt to isolate the latter nodule the uterine cavity was opened, and it was found that this supposed fibroid was a piece of necrotic ovular tissue about ½ centimeter in diameter. This, then, explained the lapsed period and the recent corpus luteum found at operation as well as the metrorrhagia. The patient denied, however, that an abortion had been performed or that any material resembling the ovum had passed previously.

CASE 6, Fig. 7. A woman, 30 years of age, who had been bleeding continuously and more or less profusely for 4 weeks came to the hospital solely because of this hæmorrhage. Her previous menstrual history was uneventful and she had not missed a period. She was very obese, so that rectal examination revealed little except pelvic tenderness and a sense of fulness. Subjectively, there was some abdominal pain of an indefinite nature, weakness, but no definite symptom complex. There was nothing at all suggestive of pregnancy in her history. Inasmuch as the history and local findings were indefinite, it was decided to seek roentgenographic aid.

Transabdominal pneumoperitoneum was induced, a litre of carbon dixoide being introduced into the peritoneal cavity, and roentgenograms taken of the pelvis. As you perceive from the diagram, there is a definitely circumscribed mass in the right half of the pelvis. Below this the cross-section of the isthmus and cervix of the uterus can be identified, and the gas distended bladder is seen anteriorly. The left half of the pelvis is occupied by a shapeless, irregular mass resembling clouds on the film. This is quite characteristic of blood and clot in the peritoneal cavity. The fundus of the uterus is completely obscured by the aforementioned shadows.

On the basis of the roentgen findings, laparotomy was performed and a right tubal pregnancy was removed. There was about a pint of blood and clot in the belly.

The statement that the most typical thing about an ectopic pregnancy is that it is atypical is certainly borne out in this case in which uterine bleeding was the only clew to its presence, aside from the roentgenographic evidence on the film after pneumoperitoneum.

CONCLUSIONS

1. Roentgenography after gas inflation of the abdomen is of material aid in gynecological diagnosis.

2. It is not a routine measure, the usual gynecological examination sufficing ordinarily.

3. In obese, unco-operative, ignorant, or mentally deficient women it may be the only means of accurate diagnosis before operation.

4. Its value lies not alone in positive evidence but also negatively in allaying suspicion of pregnancy or pelvic lesions with few palpatory findings. As a *matter of record* it has great value.

5. It is a safe method—no accidents occurring in our series of about 150 cases (Peterson's over 300). Two accidents per 1,000 are reported in the literature (Coliez).

6. The uterus, ovaries and fallopian tubes, round ligaments, and bladder can be clearly depicted on the X-ray film by a careful technique.

7. Pelvic pathology is graphically shown by silhouetting the viscera on the film after surrounding them with gas. Tumors are readily differentiated.

8. Carbon dioxide is preferred to air or oxygen because of more rapid absorption. All three gases are safe.

9. The transuterine route is preferable when the Rubin test proves the tubes permeable. The latter procedure is of distinct value in sterility both diagnostically and therapeutically.

In our hands the roentgenogram was in some instances the sole means of accurate diagnosis. In others it was the deciding factor in settling differences of opinion. In still another group it portrayed normal pelvic viscera when history and opinion indicated otherwise, and proved of great value as a matter of record.

I am greatly indebted to Dr. R. A. Arens, roentgenologist at Michael Reese Hospital, for his patience, interest and support, under whose directions all of our films were taken.

LITERATURE

1. Alvarez, W. C. Am. J. Roentgenol., 1921, viii, 71. Idem. California State J. Med., 1920, xviii, 42.
2. Burch, L. E. J. Tennessee M. Ass., 1924, xvii, 154.
3. Carelli, H. H. Am. J. Roentgenol., 1923, x, 259.
4. Chueco, A. Semana méd., 1922, ii, 948.
5. Coliez, R. J. de radiol. et. d'électrol., 1923, vii, 66.
6. Coliez, R. Gynec. et. Obst., 1921, iv, 562.
7. Cron, R. S. Wisconsin M. J., 1922, xxi, 215.
8. Donarre. J. de radiol e. d'électrol., 1921, v, 368.
9. Dyroff, R. Deutsche med. Wchnschr., 1924, l, 572.
10. Friedlander, B. J. Michigan State M. Soc., 1923, April.
11. Goetze, O. Deutsche med. Wchnschr., 1919, xlv, 491.
12. Hernaman-Johnson, F. Brit. M. J., 1922, ii, 511.
13. Hyman, A. S. Med. Rec., 1920, xcvii, 100.
14. Lorey, A. Muenchen. med. Wchnschr., 1922, lxix, 86.
15. Martin, C. L. Texas State J. M., 1922, xvii, 577.
16. Mayer, A. Zentralbl. f. Gynaek, 1020, xliv, 1370.
17. Mundell, J. J. Virginia M. Month., 1922, xlix, 130.
18. Orndoff, B. H. J. Roentgenol., 1919, ii, 265.
19. Idem. Illinois M. J., 1920, xxxvii, 408.
20. Idem. Illinois M. J., 1921, xxxix, 61.
21. Idem. Surg., Gynec. & Obst., 1920, xxx, 337.
22. Peterson, R. Surg., Gynec. & Obst., 1921, xxxiii, 154.
23. Idem. J. Am. M. Ass., 1922, lxxviii, 397.
24. Idem. Am. J. Obst. & Gynec., 1921, ii, 349.
25. Peterson R., and Van Zwaluwenberg. Minnesota Med., 1921, iv, 415.
26. Idem. Am. J. Roentgenol., 1921, iii, 12.
27. Rautenberg, E. Deutsche med. Wchnschr., 1919, xlv, 203.
28. Rubin, I. C. A. J. Roentgenol., 1921, viii, 120.
29. Idem. J. Am. M. Ass., 1920, lxxv, 661.
30. Sage, E. C. Nebraska M. J., 1922, vii, 244.
31. Sante, L. R. Am. J. Roentgenol., 1921, viii, 404.
32. Schittenhelm, A. Deutsche med. Wchnschr., 1919, xlv, 566.
33. Schmidt, A. Deutsche med. Wchnschr., 1919, xlv, 201.
34. Stein and Stewart. Ann. Surg., 1919, lxx, 95.
35. Idem. Am. J. Roentgenol., 1919, vi, 533.
36. Idem. New York State M. J., 1921, xxi, 245.
37. Idem. J. Am. M. Ass., 1920, lxxv, 7.
38. Idem. Monograph. Southworth Co., 1924.

DERMATOLYSIS

A Review with Report of a Case

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From the service of Dr. Charles M. Williams

THE subject of dermatolysis is a complicated one. Under this title, a number of abnormal skin conditions have been described in the literature and reviewed in textbooks. Recently we have observed a case which we considered an example of the localized or circumscribed form of dermatolysis, and we are taking this opportunity of reviewing dermatolysis and describing our own case both clinically and histologically.

Dermatolysis is regarded as a rare disease. It is variously known as loose skin; cutis laxa; cutis pendula; pachydermatocele; and chalazoderma. The partial or circumscribed form of dermatolysis is characterized by areas of hypertrophy and looseness of the skin and subcutaneous tissues. The affected area of skin may hang in loose folds or be sufficiently elastic to allow of stretching. The appearance of the surface of the integument may be normal, hyperpigmented, with dilated and gaping follicles or comedones. The skin is usually thickened, but exceptionally it is thinner than normal. On palpation, one gets a doughy or velvety soft feel of a greasy, uneven surface. The sensation may be unaffected or hypersensitive. There are no subjective symptoms. Although any part of the body may be affected, the locations most frequently involved are the face, especially the eyelids; the neck; the abdomen; and the genital region. The condition is somewhat progressive. After reaching a certain stage of development it may remain stationary.

The etiology is unknown. In certain instances the condition is congenital, in others hereditary (several generations); but usually it is acquired. The starting point may be the site of former trauma, and the vague term of "trophoneurosis" has been applied to the causation.

The diseases which may be confused with dermatolysis include diffuse dermatolysis or cutis hyperelastica. The "elastic skin" or indiarubber man of the circus side show is an excellent example of this form of dermatolysis. Here the integument is generally loosely attached to the subcutaneous tissue, and has the property of great distensibility occurring normally in the young of certain animals, as kittens. Diffuse dermatolysis has been studied by a number of observers.

Dermatolysis must not be confused with the relaxation of the skin and subcutaneous tissues encountered in senility and after pregnancy. In both of these, hypertrophy of the constituents of the skin is lacking. Nævi and sebaceous cysts are readily distinguished by the absence of the features of true partial or circumscribed dermatolysis. The relaxation and hanging-in folds of the skin are features of pseudoxanthoma elasticum, but associated papules and plaques are absent in dermatolysis. Whether or not to include fibroma pendulum in the group of circumscribed dermatolysis is indeed a problem. We consider that the pre-existent tumor is not a feature of localized dermatolysis, and on this ground exclude fibroma pendulum as well as the depressible fibrous tumors associated with so-called von Recklinghausen's disease, and the benign multiple new growths of Schweninger-Buzzi.

The histological features of partial dermatolysis are hypertrophy of all portions of the skin, especially an increase in the fibrous bundles. The subcutaneous tissue shares in the general hypertrophy.

There is no tendency to spontaneous involution. Treatment is purely surgical. There is no tendency to recurrence.

Examination of the prepared sections from our case revealed that the greatest abnormality existed in the derma. It was markedly broadened. Swirls of loose fibrous tissue occupied four or five times the normal area of derma. The tissue was in cross section, longitudinal, and irregular. Clear areas of

œdema were interspersed between layers of fibrous tissue. Nuclei were sparse compared to the number of fibers. Numerous small capillaries were seen with normal walls. The lumen of the capillaries were dilated but empty of cellular content. Branching of some of the capillary vessels was seen.

The hair follicle and sebaceous glands present were broadened and somewhat lengthened.

Several islands of epidermic cells about a third way down in the derma were present. No connection with the epidermis was found.

The papillary bodies were insignificant. Along most of the section, the papillary bodies were irregular.

The line between the derma and epidermis was demarcated by a line of hyperæmic, vacuolated cells of the pigmented basal layer.

The epidermis was thinned. The prolongations down of the pegs were irregular, sometimes branched, but never conglomerate. The surface was in distinct folds. The horny layer was adherent within the folds and filled the pits. Over the hair follicle, the surface was indented and filled with a veritable keratotic plug. The summits of the folds were practically free of horny layer cells. The keratinization was normal.

The Malpighian layer was much thinned; varying from five to ten cells thick. The cells were rather closely packed without much separation of the prickles. There was a clear space about some of the nuclei.

The cells of the basal layer were swollen. The cell protoplasm was almost ballooned with fluid, and the nuclei sometimes were to one side, and sometimes in the middle. The pigment granules were restricted to the basal layer cells, but the pigmentation was distinctly increased.

What little subderma there was present in the section, showed dilated vessels of normal thickness. The sweat glands were of normal appearance.

The Weigert elastic tissue stained sections showed the elastic fibers directly beneath the basal cells layer to be practically continuous. The fibers were thicker than normal, curled, and branched. Other elastic tissue fibers seemed crumbled. In the derma proper, the amount of elastic tissue fibers present seemed small. The circumvascular elastic fibers were normal in thickness. In the neighborhood of the hair follicle and sebaceous glands, the elastic fibers were more numerous.

Fig. 1. Photograph showing lesion on author's patient.

CASE REPORT. Miss F. F., an American-born school girl 15 years of age, first presented herself to the clinic of the New York Skin and Cancer Hospital, August 13, 1924. Her family history was negative, except that a sister had had an erythematous eruption probably toxic in nature which disappeared spontaneously. Her past history had no bearing on the condition presented. As far back as the patient or her parents remembered, probably from earliest infancy, a small spot had been noticed in the center of the back of the neck just below the hair margin. This lesion had gradually increased in size, slowly at first, apparently more rapidly within the past year. She now presented a raised slightly pendulous area of skin on the nape of the neck measuring 2¼ x 1⅛ inches, the long axis of which was parallel to the long axis of the vertebral column. The follicular openings in this area were enlarged but the hair was fine and sparse. The skin was lax, the natural folds and rugæ enlarged giving rise to an uneven surface which was slightly more pigmented than the surrounding integument. The skin could not be drawn out farther than its redundancy permitted. The patient had no other skin abnormalities.

The patient's general health was good. The neurological examination revealed nothing abnormal and the patient had kept up with her classes at school. She was apparently of average mentality.

The lesion was removed under local anæsthesia by Dr. William Asbury Smith (now of Beaumont, Texas) and the wound healed resulting in a linear scar.

THE QUESTION OF GASTRO-ENTEROSTOMY IN DUODENAL ULCERS[1]

By GEORGE WOOLSEY, M.D., F.A.C.S., New York City

FIVE years ago I read a paper on "The Results of Operation in Gastric and Duodenal Ulcers" (20). Since then a great amount has been written on the end-results of gastro-enterostomy. It has become the custom, if not the fashion, to condemn the operation. This is not unusual but is what is to be expected as a natural swing of the pendulum, so often exemplified in the history of medicine. By this I do not mean to say that many have not had reason to criticize the operation and its results. We can understand this criticism especially when we remember that so much depends upon the proper selection of cases, which means the exclusion of all in which an ulcer cannot be demonstrated, upon a proper technique, and upon careful after-treatment.

At the time of my previous paper I found that in 91 per cent of my cases the late results were satisfactory. I have re-examined these cases, including only those operated upon 4 or more years ago, looking up the more recent follow-up reports, and inquiring as to the present condition in other patients. I have been unable to get reports from nearly 25 per cent of the patients after they have left the hospital. These have to be eliminated, though, in my experience, most of such patients if we do hear from them have no complaint to bring them back.

I have been able to follow 60 cases from 12 years to 3½ months, the average of the follow-up reports being 32 months. In 88.33 per cent the result was satisfactory. If we exclude 1 case in which a marked ptosis of the right kidney accounted for the present symptoms, the result is satisfactory in 90 per cent. Of the other cases, classed as failures, 1 patient was well for 6 years and then had a recurrence of ulcer on the posterior surface of the duodenum, the original ulcer being on the superior surface. The stoma was found contracted to the size of the finger. Another patient was well for 2 years when symptoms of duodenal ulcer recurred. Another had recurrence of symptoms after 8½ months. The gastric acidity was normal and he was relieved by medical treatment. Another patient with psychic disturbances was reoperated upon 1 year after the first operation but nothing was found and the stoma was in good condition. In only 1 case was there evidence of jejunal ulcer. This patient, operated upon 9 years ago, had been well for 15 months or more after operation when symptoms returned. He re-entered Bellevue Hospital a few weeks ago, but left before an X-ray examination was made to confirm the clinical diagnosis of jejunal ulcer.

Of the patients classed as improved, who at times complain of abdominal symptoms, none gives typical ulcer symptoms or symptoms similar to those before operation. About 50 per cent of them suffer from constipation and about 75 per cent have occasional symptoms somewhat suggestive of a gall-bladder lesion, that is, epigastric fullness after eating and pain or distress partly relieved by the belching of gas. I have recently operated on one of these patients, 8 years after the first operation. She was well for 2 years and then had symptoms diagnosed as gall-stone colic. A chronic gall bladder with gall stones was found and removed. The ulcer was healed, though the X-ray showed a deformed cap from scar tissue. The gall bladder was removed only 4 times in this series at the time of the gastro-enterostomy, and only once for stones. The appendix was removed in 45 per cent of the cases, or whenever there was evidence of inflammation. In 5 cases it could not be brought up into the wound for examination, in 7 it appeared normal, and in 20 it was not mentioned in the history. If there is any suspicion of chronic inflammation of the appendix or gall bladder, removal is indicated.

All other foci of infection should be removed, especially infected teeth and tonsils. For years I have been particular about the diet of the patients during their stay in the

[1] Read before the Bellevue Hospital Alumni Association, May 6, 1925.

hospital and for some months thereafter. By observing these precautions I think that the number of patients classed as well will increase at the expense of those classed as improved. On the whole I think that our results are satisfactory, though the percentage is a very little lower than it was 5 years ago.

When we examine the literature we find a number of surgeons, especially German surgeons and those most influenced by German surgical literature, who, with a rather high mortality and indifferent results, have abandoned gastro-enterostomy and substituted gastrectomy, entailing a higher mortality to obtain better results.

It is difficult to explain the poor results obtained by many surgeons. There are a few simple principles that must be observed if good results are to be obtained from gastro-enterostomy for duodenal ulcers.

1. It should never be done unless the ulcer can be seen or felt.

2. A few essentials in the technique are: (a) The opening is made so that it lies at the most dependent part of the stomach; (b) only absorbable sutures are used; (c) the proximal loop of jejunum is made short but not taut; (d) all foci of infection, intra-abdominal and extra-abdominal, must be removed and careful diet instituted. With these simple rules the mortality should be low and the poor results and sequelæ few. Of the sequelæ, jejunal or marginal ulcers have caused the most criticism of gastro-enterostomy. Balfour (1) states that in 2 per cent of the large number of gastro-enterostomies at the Mayo Clinic, jejunal ulcer developed. Koennecke and Junge (10), report jejunal ulcer in 4 per cent of 520 cases. Lewisohn (11) states that it is generally assumed that jejunal ulcer follows in 5 per cent of cases. As Balfour (1) says, the symptoms of jejunal ulcer are easily recognized and the diagnosis is confirmed by the X-ray in more than 95 per cent of cases. The pain is usually lower, often to the left and, as Lewisohn says, it is more intense. A few jejunal ulcers occur later than the 2-year limit given by Sherren (19). Koennecke and Junge (10), in 22 cases, found only 3 ulcers developing from 3 to 9 years later. The real cause is unknown and they still occur when the contributing causes that we know are eliminated. In my small series it has occurred in less than 2 per cent of the cases we have been able to follow.

The discrepancy between 2 and 4 per cent, from actual series of cases referred to above, is not so great but that it may be explained by differences in technique and other factors. But in a recent paper by Lewisohn (11), he says that in 68 cases traced 4 to 9 years after gastro-enterostomy for duodenal and pyloric ulcers, jejunal ulcer was proved by operation in 18 per cent and diagnosed by the X-ray together with clinical symptoms in 16 per cent, a total of 34 per cent. These figures are to me inexplicable and so at variance with the general experience that it seems as if there must be some peculiar factors to account for them. Some may be explained by failure to follow the few simple rules I have laid down for gastro-enterostomy, but that alone is hardly sufficient. Eusterman (6) finds that there is a tendency to recurrence of ulceration in the Hebrew, and in those with a highly irritable nervous system who smoke excessively. The intemperate use of tobacco, alcohol, and condiments, hasty eating of bulky indigestible food soon after operation, also fatigue, exposure, and infection are predisposing causes. These factors may in part explain Lewisohn's experience as his report is from the Mt. Sinai Hospital. Apparently Pagenstecker thread was used for the outer peritoneomuscular suture in most of Lewisohn's cases.

As Renton (17) has shown in 3 cases and in animal experiments, the outer suture, if unabsorbable, tends to work its way into the lumen and be cast off, even when it has not penetrated the mucosa. In this process it is obviously a source of infection. This has been demonstrated by many other observers. In a study of jejunal ulcer Guillaume and Haralamibidis (9) in discussing preventive measures, emphasize avoiding local irritation, especially from sutures and hyperacidity, and, particularly, keeping up medical treatment after operation.

The von Eiselsberg exclusion method has been given up as it is followed by a high

percentage of jejunal ulcers (17 per cent, von Haberer). However, Lewisohn says that the Berg exclusion has not increased the percentage of jejunal ulcers. With our most careful efforts it must be admitted that in a small percentage of cases gastrojejunal ulcers do develop but this should not occur in over 2 or, at most, 4 per cent.

But there are other criticisms bearing on the problem of gastro-enterostomy. Hæmorrhage is not entirely prevented if it has occurred previously. Balfour (2) found that in 13 per cent of such cases the ulcers will bleed again if they are not excised. He classes bleeding ulcers and small ulcers on the anterior wall as a group suitable for excision. Since in 87 per cent of bleeding ulcers no further hæmorrhage occurs after gastro-enterostomy we may, as Peck (16) says, do a gastro-enterostomy as the first step, if excision is not applicable in a given case. Hæmatemesis or melæna occurred in 5.7 per cent after gastro-enterostomy in the 1,000 cases reviewed by Balfour (3) from the Mayo Clinic, but the bleeding subsides on treatment, especially if it was not present before operation. In many such cases the bleeding comes from the ulcer and not from the stoma. As Balfour (3) says "serious hæmorrhage from the anastomosis must be regarded as a technical blunder for which the surgeon assumes responsibility," though Metge (13) reports 4 deaths from hæmorrhage after gastro-enterostomy.

Although Balfour (3) states that "protection against subsequent perforation is absolute since not a single case has occurred among these 1,000 patients," F. M. Douglas (5) reports 1 case 3 days after operation.

Lewisohn (11) thinks that gastric acidity is not altered by gastro-enterostomy. In my own cases which show the gastric analysis both before and after operation, the acidity was reduced to below normal in 63 per cent and to normal in 27 per cent. These analyses were made from 1 month to 8 years after operation. Eusterman (7) reports from the Mayo Clinic that the total and free acid was reduced from 40 to 60 per cent after gastro-enterostomy. In 285 cases, showing the gastric analysis before and after operation, Sherren (19) found 131 with no hydrochloric acid, 65 in which it was greatly reduced, 52 in which it was reduced to normal, and only 37 in which it was not reduced. In the first group there was no return of symptoms; in the second the end-results were satisfactory; in the third, symptoms persisted in 5 only; while in the fourth, 17 had symptoms, including all who had jejunal ulcer, 5 in number.

In nearly every case of my series, when the postoperative acidity was above normal, the result was unsatisfactory. This was true of the only case of jejunal ulcer, the total acid being 76, and the free hydrochloric acid 61, 14 months after operation.

The importance of the reduction of hyperacidity is generally recognized and is well expressed by Balfour (3) who says: "The recurrence of ulcer after gastro-enterostomy or, in fact, after any type of operation is apparently directly associated with failure to reduce the acidity, to maintain this reduction, and to provide adequate drainage." For this purpose the stoma should reach to the lowest point of the greater curvature.

The relation between hypo-acidity and freedom from ulcer is not invariable since well-developed ulcers exist with achlorhydria. Several cases in my series showed a low or normal acidity before operation and one of these was unimproved. At least 5 of my cases which were only improved had a low postoperative acidity. A high pre-operative acidity seems to be a favorable factor. Thus of those of this type 86.6 per cent were free of all symptoms after operation and only 6.6 per cent were unimproved.

In all these series of cases a large percentage of the patients with duodenal ulcer treated by gastro-enterostomy are entirely well. Others, forming a smaller group, have occasional abdominal symptoms, not like those originally complained of, which do not interfere with their work or their enjoyment of life. In the vast majority of such patients the ulcer has healed and the occasional symptoms of indigestion are functional or due to extra-gastric causes. No operation can insure a patient against occasional indigestion.

These two groups, those classed as well or improved, comprise the satisfactory results

and represent from 80 to 95 per cent of the cases. Balfour (3) in 1,000 cases operated on at the Mayo Clinic, 10 or more years before, found satisfactory results in 88 per cent. W. J. Mayo (12) says that gastro-enterostomy cures over 90 per cent of duodenal ulcers, and Peck (16) in a recent article, states that 80 to 90 per cent of the patients were completely relieved of symptoms. Sherren (3) in 500 cases reports 92.6 per cent perfectly well, 2 or more years after gastro-enterostomy. Not all continental surgeons report unsatisfactory results. Galpern (8) says that in duodenal ulcer gastro-enterostomy gave 78.2 per cent of excellent results, and 19 per cent of bad results. Schwyzer (18) found that gastro-enterostomy gave relief in 80 per cent for 4 years; later the number was reduced to 75 per cent.

The small percentage of unfavorable results include the few jejunal ulcers and recurrent ulcers in the duodenum or stomach. Such recurrent ulcers, whether jejunal, duodenal, or gastric, form a small group suitable for gastrectomy.

Most of the failures in Balfour's (3) series were in the 129 cases in which the appendix was not removed. Eusterman (7) says that in from 13 to 18 per cent of all cases of chronic ulcer there is associated gross disease of the gall bladder. I agree with Blackford and Dwyer (4) that "if the careful internist says that the gall bladder should be removed on the clinical and physical evidence, the surgeon must seriously consider his responsibility in saying that the gall bladder appears normal and in leaving it alone." The difficulty lies in diagnosing from symptoms alone a slightly diseased gall bladder without stones when the picture is obscured by the symptoms of ulcer.

But there will still be a very few patients in every hundred operated upon who complain of vague symptoms, often functional in origin, frequently associated with constipation, who sometimes are neurotic or mentally disturbed, whose treatment should be medical and dietary and not surgical.

What are the alternatives to gastro-enterostomy for duodenal ulcer? The three following will be briefly considered:

1. *Medical treatment.* The majority of patients that come to the surgeon have had one or more courses of medical treatment with relapse. Nielson (15) re-examined 239 patients after they had been treated medically 2½ to 19 years. In 95 to 98 per cent of the cases the patients were discharged symptom free, but 200, 83.7 per cent, were not permanently cured. The longer the duration of the ulcer the larger the percentage of recurrences. If we take into account the results of hæmorrhage and perforation, medical treatment has a higher mortality than surgical treatment, as Moynihan (14) says in his Hunterian lecture. The mortality of gastro-enterostomy is about 2 per cent. Moynihan had 500 consecutive cases without a death.

2. *Excision or pyloroplasty.* Excision is applicable to some bleeding ulcers and to recent, single, small ulcers on the anterior wall of the duodenum, without scar formation or stenosis, but this includes only a small group. Ulcers giving repeated hæmorrhage are better treated by excision if this is technically applicable. In suitable cases it gives satisfactory results and may be combined with pyloroplasty or gastro-enterostomy. Balfour (3) states that even in small recent ulcers, experience in the Mayo Clinic shows that excision, with or without pyloroplasty, gives no better end-results than gastro-enterostomy.

Pyloroplasty affords the opportunity to excise the ulcer in a moderate percentage of cases. It does not prevent the re-formation of ulcers. Thus Horsley (3) observed recurrence along the suture line in nearly 10 per cent of cases. Eusterman (7) states that experience with several hundred pyloroplasties has not been encouraging, and that at least 15 per cent of pyloroplasties are later subjected to gastro-enterostomy with good results. An advantage of gastro-enterostomy lies in the fact that it is non-destructive and can be undone.

3. *Gastrectomy.* This is a more serious operation and gives a mortality at least two and a half times as great as gastro-enterostomy, that is, 5 per cent (von Haberer) against 2 per cent or less. Lewisohn (11) gives the mortality as 5 to 10 per cent. That

it does not insure against recurrence is evidenced by Finsterer's (3) report of 6 cases in which ulcer occurred after partial gastrectomy.

The achlorhydria produced is not always without bad effects. According to Balfour (3) patients with achlorhydria frequently present a definite syndrome of gastric symptoms which may be more disabling than those for which the gastrectomy was performed.

There is however a small but definite group in which partial gastrectomy is indicated. This includes those duodenal ulcers which cause severe hæmorrhage, in which gastro-enterostomy may fail to relieve the symptoms and pyloroplasty or excision cannot well be applied, also those with recurrence of ulcer locally or at the stoma.

The recurrence of ulcer in 3.5 to 5 per cent of cases after gastro-enterostomy does not justify gastrectomy in 100 per cent when the mortality of the latter is two or three times as great. I agree with Charles Mayo who, in the discussion of Balfour's paper (3), said that he would not allow anyone to remove half of his normal stomach to cure a duodenal ulcer.

CONCLUSIONS

Late results. Many series of cases of duodenal ulcer treated by gastro-enterostomy by American and British surgeons give satisfactory results ranging from 80 to 95 per cent; my own series shows 90 per cent. Jejunal ulcer follows gastro-enterostomy in about 2 per cent of cases. In many cases improved (not cured) by the operation the ulcer is healed and the symptoms present are due to extragastric causes, commonly the appendix or the gall bladder. Bleeding occurs in only a small percentage (5.7 per cent) after gastro-enterostomy and as a rule this hæmorrhage is not serious. Gastric acidity is much reduced by gastro-enterostomy and remains so. This is essential to the best results.

A few simple rules must be followed to obtain good results: (a) A gastro-enterostomy should be done only when the ulcer can be seen or felt; (b) a good sized opening at the lowest point of the stomach should be made; (c) only absorbable sutures should be used; (d) extra-gastric causes of gastric symptoms and all foci of infection must be removed; (e) the after-treatment and diet must be as strict as that used in the medical treatment of ulcer.

Excision is applicable in a small group of cases, with or without gastro-enterostomy. Pyloroplasty is a good operation but the results are inferior to those of gastro-enterostomy. Gastrectomy has a much higher mortality and is not justifiable as a routine to avoid the small percentage of recurrences. It is applicable in a small group to cure recurrent hæmorrhage or ulceration, jejunal, duodenal, or gastric.

REFERENCES

1. Balfour, D. C. Ann. Surg., 1924, lxxix, 386.
2. Idem. Ann. Surg., 1923, lxxviii, 206.
3. Idem. J. Am. M. Ass., 1924, lxxxiii, 603.
4. Blackford, J. M., and Dwyer, M. F. J. Am. M. Ass., 1924, lxxxiii, 412.
5. Douglas, F. M. Ann. Surg., 1922, lxxvi, 222.
6. Eusterman, G. B. Minnesota Med., 1923, December.
7. Idem. J. Am. M. Ass., 1921, lxxvii, 1246.
8. Galpern. Arch. f. klin. Chir., 1923, July.
9. Guillaume and Haralamibidis. Bull. méd., 1923, August 11 and 18.
10. Koennecke and Junge. Arch. f. klin. Chir., 1923, April 20.
11. Lewisohn, R. Surg., Gynec. & Obst., 1925, xl, 70.
12. Mayo, W. J. Surg., Gynec. & Obst., 1923, xxxvi, 447.
13. Metge. Zentralbl. f. klin. Chir., 1924, January 26.
14. Moynihan, B. G. A. Brit. M. J., 1923, February 10.
15. Nielson, N. A. Hospitalsted. Brit. M. J., 1923, January 13.
16. Peck, C. H. Ann. Surg., 1924, lxxx, 31.
17. Renton, J. M. Glasgow M. J., 1923, December.
18. Schwyzer. J. Lancet, 1921, September.
19. Sherren, J. Lancet, London, 1924, i, 477–481.
20. Woolsey. New York M. J., 1920, July 17.

FRACTURE OF BOTH BONES OF THE FOREARM

Study of Two Hundred Cases

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THE trend of practice at the present time is to reduce fractures by open operation only when it is impossible to obtain fairly satisfactory position by the closed method. There are cases, however, in which lack of co-operation on the part of the patient or absence of operating facilities cause the surgeon to be content with a partial reduction. It was this type of case that prompted a review of 200 fractures of both bones of the forearm treated in this clinic. The results of the study show that greater liberties can be taken if the fracture occurs before the bone growth has been completed, as will be seen in the cases reported.

There is much discussion in the literature concerning the open and closed methods of treating fractures. At a meeting in Glasgow in 1922, Young (5) remarked: "We want very much to get away from the attitude of being readily satisfied with anything short of the best attainable." Apparently indicating operation as the only method by which such a standard can be maintained, he stated that "it is the failure to adopt even yet in some surgical clinics the open operative method as almost a routine procedure, that must bear the larger part of the reproach that still remains in the sphere of fracture treatment." As opposed to this idea Dowden (3) of Edinburgh stated that he had obtained good results by reducing the fractures as well as possible without operation; that the perfect anatomical adjustment of the fragments was not necessary, but that early active and passive motion of the extremity involved was very important. In some cases he did not even splint the fracture, but placed it in a sling. He emphasized this method of treatment by saying "active movements should follow on the heels of pain." The above points of view, diametrically opposed as they are, indicate the lack of uniformity in our methods of handling these fractures. One surgeon is content only with a perfect anatomical and functional result, while a second places function first, and deformity as a secondary consideration. It is the purpose of this study to determine which of these two conflicting viewpoints is the sounder. It may well be that neither is entirely correct, nor on the other hand entirely wrong, and there is possibly a middle ground that may be followed to the best advantage.

A brief review of the anatomy of the forearm is essential to a clear understanding of the fractures which occur in this region, since the position assumed by the fragments is constant at the different levels, depending upon the particular structures involved at the site of injury.

The shafts of the radius and ulna first appear in the second month of fetal life. The olecranon appears in the tenth year and fuses with the shaft in the sixteenth year. The lower epiphysis is first found (by X-ray) in the sixth year and fuses in the twentieth. The ulna forms the articulation of the forearm with the humerus, its lower end playing an almost negligible part in movements at the wrist. Just the reverse condition holds true for the radius, in that its lower end plays the leading rôle in the movements of the wrist, whereas, its upper end serves only in a minor capacity at the elbow joint. In supination the bones of the forearm lie parallel whereas in pronation the radius is rotated about the ulna and crosses it at about its middle third.

If the origin, insertion, and action of the muscles of the forearm are considered in the reduction and fixation of these fractures, the task is frequently simplified and a better result obtained. This phase of the anatomy of the forearm is important (Fig. 1).

The brachioradialis muscle arises from the lower end of the humerus and is inserted into the lower end of the radius. It assists in flexing the forearm and is also a semi-pro-

nator and semi-supinator, bringing the forearm from the supine or prone position to one in which the radius is uppermost. Therefore, the maximum relaxation of the muscle is obtained when the elbow is flexed and the hand midway between supination and pronation, the usual position for splinting a fracture of the forearm. As practically all the extensor muscles of the hand and fingers arise from the lower end of the humerus, they cause little pull on the fragments but aid in splinting the radius and ulna posteriorly when under tension, as when the elbow is flexed.

The supinator muscle arises from the lower end of the humerus laterally and the upper end of the ulna, and passes distally and medially to be inserted into the upper third of the radius. Thus, a fracture between the upper and middle thirds of the radius would have the upper fragment supinated and the lower fragment pronated by the pronator teres muscle. This muscle arises from the lower end of the humerus medially and the coronoid process of the ulna, and is inserted into the middle third of the radius. The action and position of these opposing muscles in pronation and supination is shown in Figure 1.

The more powerful flexor muscles of the forearm have a tendency to produce dorsal bowing of the radius and ulna during healing, as their pull is not counteracted by the weaker extensor muscles on the dorsum.

With these essential anatomical facts in mind we can now proceed to a consideration of the points brought out by a study of the 200 cases in which both bones of the forearm were fractured. These have been grouped together in Table I.

In considering the age of the patient at the time of fracture it was noted that the vast majority of fractures of both bones of the forearm occurred before the age of 15, only 24 of the patients in this series being older. It is extremely interesting to note that 110 patients were less than 10 years of age.

In 183 cases the fracture sustained was the result of force applied indirectly, that is, the injury was usually the result of a fall on the outstretched hand. Bearing this in mind we can conceive that the natural bowing of the bones, to be described, may determine in a measure the location of the fracture. The remaining 17 cases were the result of force applied directly, such as blows, crushing injuries, gunshot wounds, etc.

TABLE I.—STATISTICAL STUDY OF TWO HUNDRED CASES

	Cases
Age	
0 to 10 years	110
11 to 15 years	66
Over 15 years	24
Etiology	
Direct violence	17
Indirect violence	183
Site of fracture	
Upper third	16
Middle third	79
Lower third	101
Epiphyseal separation	4
Variety of fracture	
Complete	94
Greenstick	96
Compound	10
Injury	
To bone	200
To soft parts	17
Reduction	
Closed—good	172
Closed—fair	18
Open operation	10
Results	
Satisfactory	194
Unsatisfactory	6

The idea seems prevalent that following indirect injury in children epiphyseal separation is to be expected rather than fracture of the lower end of the radius and ulna (Baetjer and Waters, 1). Such a point of view finds no support in the present study since in the 200 cases included, epiphyseal separation occurred in only 4 instances (approximately 2 per cent). This would seem to indicate that the epiphysis is not the weakest point as is commonly supposed; but that as a result of indirect violence, such as falling on the outstretched hand, fracture is to be expected rather than epiphyseal separation. The explanation of this observation may lie in the following facts: (1) There is little or no strain or leverage exerted on the epiphysis by indirect trauma; (2) the epiphysis is protected to a very great degree by the tough capsule of the neighboring joint; (3) the elasticity of the epiphysis,

with its cartilaginous attachment, is much greater than that of the diaphysis.

The radius and ulna were divided into thirds, and it was found that 101 fractures occurred in the lower third, 79 in the middle, and 16 in the upper third. The reason for this distribution is not immediately apparent. Is it because these bones are sturdier in the proximal third than in the distal two-thirds, or is it perhaps because the upper portion of the bones is better protected by the muscles of the forearm? One or both of these reasons may be applicable. It is certainly true that the proximal portion of these bones is thicker and larger since at this site the muscles of the forearm have their origin and the muscles of the upper arm their insertion. In addition to the above mentioned factors which may aid in the prevention of fractures in the upper portion, there is a natural bowing which may account for the predominance of fractures in their distal portion.

Within the brief scope of this paper it was not deemed essential to enter into any detailed classification; hence the series was divided simply into complete, incomplete or greenstick, and compound fractures. Ninety-four of our cases were of the first variety, 96 of the second, and 10 of the last. It is usually stated that in children the predominant type of fracture is the greenstick variety. To explain this idea it has been held that the bones of children are soft and hence more elastic and for this reason are more liable to bend than break. Such would seem to be logical reasoning, though it is interesting to note that in this series incomplete fractures occurred almost as frequently in children as complete ones, there being 96 of the former and 80 of the latter.

In simple fractures the soft parts were rarely injured seriously. Occasionally, however, a small hæmatoma developed over the site of fracture but in every case was promptly absorbed. Nerve injury was never present in the simple cases. In those cases resulting from direct violence all varieties and degrees of injury to the soft parts were found, making amputation necessary in a few instances.

In fractures of the forearm, as elsewhere, the necessity for prompt reduction is obvious.

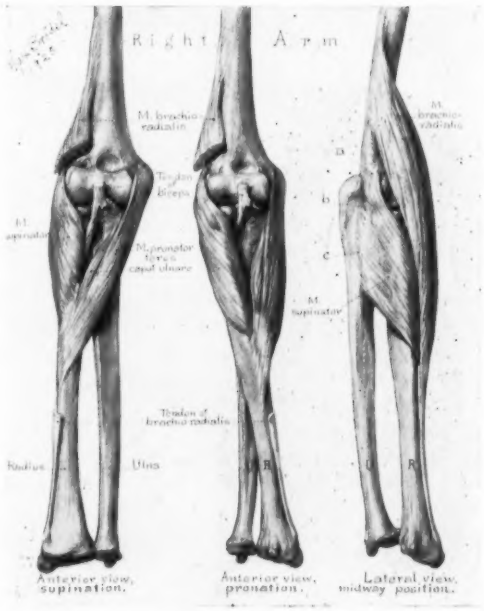

Fig. 1. Illustrating that particular part of the anatomy of the forearm most frequently fractured.

Gould (4) says: "Reduction of the fragments should be complete or perfect at once; we should not rest in any half-way house content with an improvement today with the hopes of still greater correction tomorrow." In all reductions of the forearm three aims should be kept in mind: (1) as rapid firm bony union as possible; (2) as complete anatomical correction of fragments as possible; (3) as early active and passive motion as possible. It is not always advisable to subject the patient to repeated reductions in order to obtain a perfect position of the fragments, because an extremity which has been immobilized for a great length of time or which has been subjected to repeated manipulations is likely to have impaired function for a considerable length of time afterward. One might infer from this that good function is better than a condition which the X-ray plate shows as anatomically perfect.

Whenever possible a closed reduction was done, there being 190 cases in this series, the other 10 being treated by open operation. In dealing with fractures traction seems to be

the secret of success. Frequently under the fluoroscope if traction alone were made on the hand and counter traction maintained on the humerus, the fragment slipped into place without manipulation. Eighteen cases were incompletely reduced, but the surgeon in charge decided to be content with the reduction obtained without operative interference. That this decision was well justified is indicated by recent examination after complete healing.

Open reduction was resorted to only when the closed method had failed, that is, in those cases with marked overriding; when excess callus from poor reduction would interfere with function or would injure nerve or blood supply; and in adults when there was little or no tendency toward spontaneous correction of deformity. In many instances we have been satisfied to leave the fragments in the position resulting from reduction by the closed method although the reduction was not anatomically perfect. We pursued this course (and this is one of the points we have desired to stress in this study) believing that the ultimate result thus secured would be far more favorable from the point of view of function than the perfect anatomical alignment secured by open reduction. Fixation was secured in 5 cases by the use of silver wire; in 3 by plates; while in 2, no internal splinting was necessary. In the rather small series of cases in which the open reduction was used subsequent removal of the material used in fixation was necessary for the relief of pain in several instances.

At the time of reduction, radiographic examination showed good or excellent alignment in 172 cases; in 18 cases the reduction was only fair; while in the remaining 10 a sufficiently good position could be obtained only by open operation.

The following observation was made during the course of study which may in a measure explain the correction of deformity which occurs subsequently to incomplete reduction in young persons. It was noted that when bowing occurred callus was laid down on the concave side of the deformity, there being little or no callus on the convex side save when the periosteum was raised from the bone by the displacement of the fragments. This occurred with a striking degree of regularity in the series studied and is well demonstrated in Figure 4. Here it may readily be seen, as for example in the ulna, that there is a heavy, dense callus extending over a distance of 7.5 centimeters on the concave side, whereas on the convex side the new bone formation has less depth and less density and extends only for a distance of about 2 centimeters. The radius likewise demonstrated the same point, strikingly illustrated in Figure 5.

Many explanations have been offered to account for the formation of callus at the site of fracture. Whether new bone arises from the cortex or from the periosteum is still a question of doubt, some observers adhering to the former view, others holding the latter to be more plausible. It is not our purpose to attempt to determine which of these two views is correct but to put forth what seems a reasonable explanation for the greater amount of callus formation found on the concave side of the bone. This, we believe, is due to the fact that on the concave side there is a relaxation of the periosteum and soft parts which permits hæmorrhage and clot formation, whereas on the convex side the periosteum is stretched and more adherent offering greater resistance to hæmorrhage beneath the periosteum and into surrounding structures. Granting that hæmorrhage takes place as described, the various stages concerned in the repair, borne out by the experiments of Bancroft (2), are as follows:

Immediately after hæmorrhage, fibrin formation and contraction of the clot occurs. This is followed by an ingrowth of connective tissue and a rushing in of small blood vessels. Following the penetration of blood vessels, two distinct and opposite processes begin, the rebuilding with live bone and the absorption of injured bone—the one task assigned by some observers to osteoblasts, the other attributed to osteoclasts.

The ultimate result as determined by follow-up studies of the group of cases seen during periods of from 1 to 10 years, shows that 194 have a good result, that is, in 194 cases there is no apparent deformity or loss

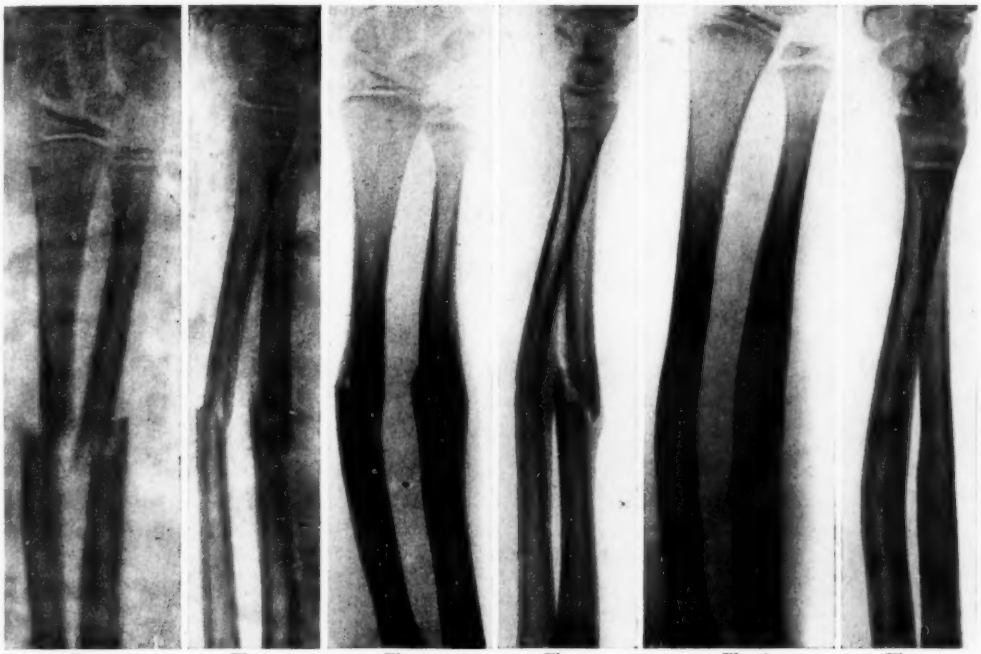

Fig. 2. Fragments after final reduction (Case 1).
Fig. 3. Same patient as in Figure 2, lateral view (Case 1).
Fig. 4. Six weeks after the accident showing callous formation on the concave side of the deformity (Case 1).
Fig. 5. Same patient as in Figure 4, lateral view (Case 1).
Fig. 6. Appearance of the radius and ulna 20 months after the injury (Case 1).
Fig. 7. Same patient as in Figure 6, lateral view (Case 1).

of function demonstrable. In 6 patients the end-results were unsatisfactory in that there was present some deformity and loss of function due to arthritis and excess callus formation. Of these 6 unsatisfactory cases, 4 were those of patients on whom an open reduction was performed. The remaining 2, and these were adults, fall in the group in which reduction was only fair. It is noteworthy, however, that in the 18 cases in which actual reduction was only fair, unsatisfactory end-results occurred in only 2 instances, and these 2 cases occurred in adults with completed bone growth.

These results we believe justify our point of view, namely, that in the reduction of fractures of both bones of the forearm in children, an imperfect reduction is preferable to an open operation. In order to bring out this point more clearly the study of 3 cases is given in detail.

CASE 1. C. B., a male, 12 years of age, suffered a fracture of the radius and ulna, August 22, 1921. Several attempts were made to reduce the fracture by the closed method. There was some improvement after each manipulation, but considerable displacement persisted as seen in Figures 2 and 3. These roentgenograms were taken after the final reduction. In the opinion of the radiographer an open reduction was called for, because of the apparent close approximation of the lower fragments with the arm in complete supination. However, the lateral view, Figure 3, taken at the same time, showed that there was a sufficient separation of these fragments to prevent ankylosis.

On the basis of this evidence, the surgeon in charge decided to be content with the reduction obtained without operative interference. That this decision was justified is well indicated by the subsequent course of the case.

The patient's arm was kept in anterior and posterior plaster splints for a period of 6 weeks. The splints were removed at frequent intervals for massage and passive motion after the tenth day. Roentgenograms taken 6 weeks after the accident (Figs. 4 and 5) indicate a satisfactory improvement

Fig. 8.

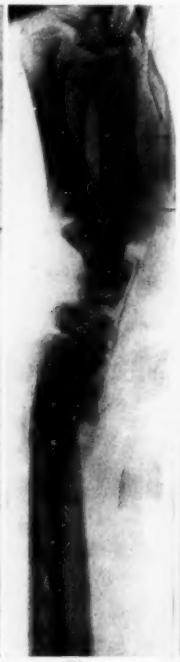

Fig. 9.

Fig. 10.

Fig. 11.

Fig. 8. Position of fragments after final reduction (Case 2).

Fig. 9. The same arm, lateral view (Case 2).

Fig. 10. Appearance of radius and ulna 3 years and 10 months after the injury (Case 2).

Fig. 11. The same arm, lateral view (Case 2).

both in the contour of the arm, which is almost without deformity, and in the general alignment of the fractured bones. Bony union is gradually taking place. There is considerable callous formation, the bulk of which is on the concave side of the bones; the jagged, protruding ends have been absorbed. The patient uses the arm without hesitancy. All the movements are normal.

He was kept under observation and roentgenograms were made occasionally, the final plates represented in Figures 6 and 7 having been taken in March, 1923, about 18 months after the injury.

In Figure 6 it is scarcely possible to see the position of the break. There is a slight, general bowing of the bones but the marrow cavity has been entirely re-established, the cortex is not appreciably thickened, the distance between the two bones at the site of the previous fracture is approximately normal. Figure 7 represents the lateral view showing practically the same changes. Examination of the arm at this time shows it to be perfectly straight and functioning well without pain or discomfort.

CASE 2. A. U., a male, age 13 years, fractured the radius and ulna on November 13, 1919.

Reduction was done under general anæsthesia but good alignment was not obtained as shown in Figures 8 and 9. There is even considerable overriding of the ulnar fragments as noted in Figure 8 with anterior displacement of the lower end of the ulna as noted in Figure 9. As this patient came within the first group, namely those in which the fracture occurred before the completion of bony growth, and also as the main deformity was in the lower end of the ulna, the surgeon prophesied a good result. The fracture was maintained in anterior and posterior plaster splints for 4 weeks, these splints being removed at frequent intervals for massage and passive motion after the tenth day.

When the patient was discharged, 6 weeks after the injury, the arm was straight, and the movements about the wrist joint were well performed and painless. He was asked to return to the hospital August 28, 1923, for observation. Figures 10 and 11 represent the roentgenograms taken at that time. Examination showed the arm to be without deformity, all the functions well performed and painless.

One is unable to find any evidence of the fracture in Figure 10. The marrow cavity is entirely re-established, there is no thickening or irregularity of either the cortex or the periosteum. The overriding of the lower end of the ulna, which was noted in Figure 8, seems to have been entirely compensated

Fig. 12.

Fig. 13.

Fig. 12. Position of radius and ulna 6 weeks after the accident in adult 60 years of age (Case 3).

Fig. 13. The same arm, lateral view (Case 3).

Fig. 14.

Fig. 15.

Fig. 14. Position of radius and ulna 3 years and 11 months after the accident (Case 3).

Fig. 15. The same arm, lateral view (Case 3).

for. Figure 11, the lateral view taken at this time, is also negative for any previous injury.

CASE 3 is representative of cases in which the fracture occurred after the completion of bony growth.

E. K., a female, 60 years of age, fractured the radius and ulna in 1919.

Reduction was effected under general anæsthesia, but only a fair result was obtained, as indicated in Figures 12 and 13, which roentgenograms were taken 6 weeks after the accident. The patient was discharged at this time complaining of some pain in the wrist but very little actual deformity. She was kept under observation until September 10, 1923. During this time there was practically no improvement in the deformity at the wrist. The pain on motion persisted and was more severe in bad weather.

At the last observation, September 10, 1923, the original deformity was about the same. She complained of painful motion about the wrist, of limitation of function and deformity. There was some atrophy of the muscles of the hand, signifying nonuse. Figures 14 and 15 represent the condition of the bones 5 years after the accident. In Figure 14 we see the same general deformity of the lower end of the radius and ulna as in Figures 12 and 13, taken 4 years previously. The periosteum and cortex of the bone is slightly thickened. There is some arthritis of the wrist joint.

Comparing this case with the previous one, both fractures being in the same location and of the same type, we see marked difference in the subsequent course of a fracture that has not been perfectly reduced in a child and one similarly treated in an adult.

CONCLUSIONS

A study of 200 cases, 176 patients being under the age of 15 years, has been made to determine the end-results of imperfect anatomical reduction of fracture of the forearm.

1. In children a good result may be expected even when a perfect reduction has not been obtained, since there is much subsequent improvement as the bone growth proceeds.

2. In children complete fracture is more frequent than the greenstick variety when both bones of the forearm are involved.

3. In adults there is a very little tendency to overcome deformity following imperfect reduction.

4. Following indirect injury or trauma, fracture of both bones is to be expected rather than epiphyseal separation.

5. When both bones of the forearm are fractured, the fracture occurs in the lower two-thirds in 90 per cent of the cases.

6. Before bony growth is complete a closed reduction is preferable to an open one, even though perfect alignment of the fragments cannot be obtained.

BIBLIOGRAPHY

1. Baetjer, F., and Waters, C. A. Injuries and Diseases of the Bones and Joints. New York: Paul B. Hoeber.
2. Bancroft, F. W. Arch. Surg., 1922, v, 646.
3. Dowden, J. W. Glasgow M. J., 1923, xcix, 81.
4. Gould, A. P. The latest word not the last word in surgery, or surgery a progressive science. Middlesex Hosp. J., Lond., 1921, xxii, 23–31.
5. Young, Archibald. Present-day treatment of fractures. Glasgow M. J., 1923, xcix, 99.

RUPTURED CORNUAL PREGNANCY

Discussion of Cornual Pregnancy and the Literature

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EXTRA-UTERINE or ectopic pregnancy is a condition of rather infrequent occurrence; however, during the past decade there has been reported a constantly increasing number of cases of tubal pregnancy as compared with normal gestation. The percentage in 1900, according to different authorities, varied from 1 case in 500 to 1 in 1,200 pregnancies. The various statistics in recent years seem to indicate that the proportion is perhaps 1 to 250. One writer (8) reports 303 cases in a series of 22,688 patients (1.3 per cent). This increase in percentage might be explained first, by our improved methods of diagnosis, and secondly by the fact that more cases receive surgical treatment and are thereby more accurately diagnosed. Then, too, the more common use of hospitals and hospital facilities with the increased number of cases reported in this decade may have some bearing.

De Lee states that extra-uterine pregnancy is considerably more frequent in city than in country practice (9). The explanation he

Fig. 1. *A*, Fundus of uterus. *B*, Cervix at point of amputation. *C*, Left cornu. *D*, Line of separation of broad ligament. *E*, Cornu elevated above fundus and containing fetus. *F*, The point of the rupture. *G*, The fimbria of right tube.

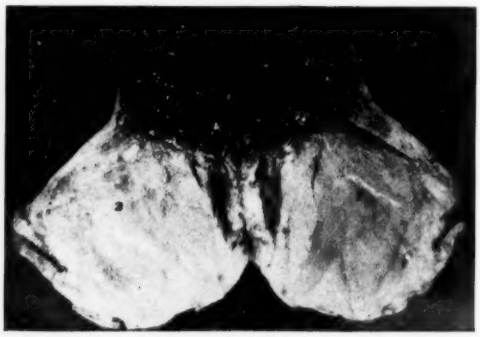

Fig. 2. Section through uterine body. *A—A*, Left cornu. *B—B*, Outline of uterine cavity. *C—C*, Cervix. *D—D*, Right cornu. *E—E*, Fetus. *F—F*, Placenta and blood clots. *G—G*, Hypertrophied cornual muscular wall. *H—H*, Fallopian tube.

Fig. 3. Photomicrograph, showing section through placenta and uterine wall, cornual region. Increased connective tissue and blood supply.

Fig. 4. Photomicrograph, showing section through embryo, uterine wall, and placenta, illustrating the embryonic structure.

offers is that the diagnostic possibilities are better in the city and the general hospitalization of city patients is more universal. Might not the greater prevalence of gonorrhœa in the populous centers furnish a rational explanation of the larger number of ectopic cases in the city, rather than the less acute diagnostic sense of the physician in country practice? If the experience of other clinics coincides with ours, I am sure gonorrhœa should be considered as the ranking etiological factor in ectopic pregnancy. In 8 consecutive cases, diagnosed as ectopic gestation in our clinic during the past 3 years, 7 were operated upon. In the 1 case in which operation was not performed the vaginal discharge was positive for gonococci. In 5 of the 7 cases, the gonococcus was demonstrated in the laboratory findings or the husband gave a history of recent active gonorrhœa. In the other 2 cases, the husband of 1 patient reported gonococcal infection 2 years previously; the second husband denied gonorrhœa, but the wife reported definite childbirth infection.

INTERSTITIAL OR CORNUAL PREGNANCY

The relative frequency with which interstitial or cornual pregnancy occurs as compared with the other types, ampullar or isthmial, might be tentatively estimated by considering the statistics of several different writers. In 77 cases observed by Martin, the following distribution is shown: ampullar type in 48 cases, isthmial in 8, cornual in 1; the balance are of the tubal, ovarian, tubal abdominal, and undetermined types (6). In a series of 106 cases Oastler (7) found the isthmial type in 38 cases, ampullar in 32, cornual in 2, and in all others the type was undetermined. In 117 cases, Foskett (4) found the ampullar in 52, the isthmial in 64, and the cornual in 1. In a paper by C. Daniel (2), he reports that Waegeli had up to the year 1915 collected only 50 cases of cornual pregnancy and in his paper he reports, in his own experience, only 2 cases. Di Palma (3) in his paper in 1920 reports only 2 cases that have come under his observation. Palmer in 1890 assembled 36 cases of pregnancy in the uterine horn, including 12 by Kussmaul and added 2 new cases of his own. Conrad (1) added 11 cases from the literature up to 1923. In his paper he describes 1 case that came under his own personal observation. He is inclined to class all these cases as pregnancy of an accessory rudimentary horn. He states that in his cited case there was no communicating cavity from the accessory horn to the uterine cavity.

In our case there is ample evidence that the impregnated cornu is not an accessory horn as the communication from both the uterine

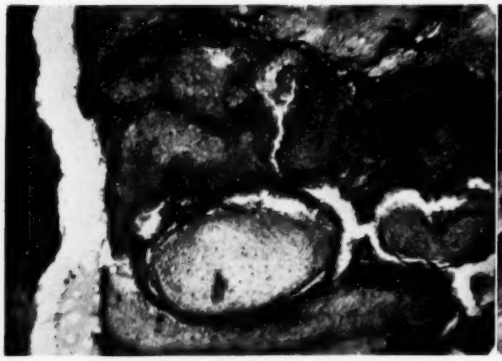

Fig. 5. Section through embryo, showing decidual cells and embryonic tissue.

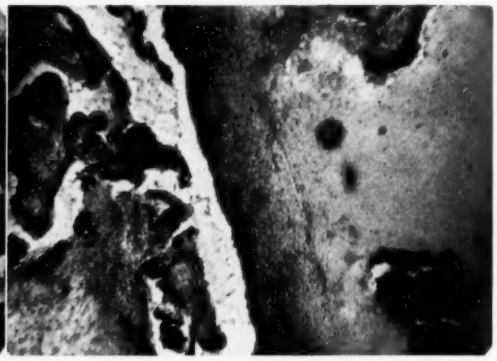

Fig. 6. Section through the placental and embryonic tissues.

cavity and the tube could be easily traced. Katz gives some interesting statistics taken from postmortem records extending over the period from 1899 to 1922 in which there was a series of 32 deaths caused by ruptured ectopic pregnancies. Of these, 23 were isthmial, 5 ampullar, and 4 interstitial or cornual. From the above it is clearly evident that the condition of cornual pregnancy is of rather infrequent occurrence.

DIFFERENTIAL DIAGNOSIS

Cornual pregnancy may never be differentiated pre-operatively from isthmial and ampullar, but the continued closer scrutiny of the histories and the more accurate interpretation of our physical findings may at least give us the occasional reward of a "par" diagnosis.

The asymmetry of the fundus, known as the Ruge-Simmons sign, in our case was only distinguishable after the abdomen was open, but on pre-operative bimanual examination it gave one the impression of a fixed tubal mass close to the uterine horn, solid enough to suggest a fibroid. This will be suggestive if encountered again with the syndrome of tubal pregnancy. The absence of any fixed mass in the opposite adnexa and the lack of cul-de-sac masses were noted in our cited case. While these did not preclude the diagnosis of ordinary pus tubes, they should also have been suggestive.

The findings on bimanual examination of an enlarged fundus, with an asymmetrical mass making its displacement forward and not toward the cul-de-sac, should always suggest a cornual ectopic condition.

CASE HISTORY

Our patient is 28 years of age, has been married 8 years, and has 1 child 7 years of age. Her entry to the Axtell Hospital was on March 25, 1924.

History. Patient's parents were both living and in good health, two brothers and one sister living and well, no brothers or sisters dead. Her past history showed that the patient was operated upon for acute appendicitis 6 years previously. There was no history of any miscarriages. The patient believed she had had some pelvic infection, probably gonorrhœal, originating about 2 years before and persisting in subacute form up to the present time. This infection had been so severe at times that the patient had gone to bed with fever and pelvic pains. Her menstrual history up to 2 years ago was normal, not painful and fairly regular. For the past 2 years, the periods had been more painful and inclined to more irregularity. The January period was normal and on time. The February period was passed and patient consulted a physician for this condition and I presume received the usual placebo. She stated that early in March she flowed a few days, then the period stopped and again after a few days she had a considerable amount of discharge with only slight bloody show. This discharge had entirely ceased on the day prior to her entry to the hospital, which was the first day she experienced acute symptoms. On Monday, the day prior to her hospital entry, at 11:00 a.m., while going about her ordinary household duties, she fell over in an unconscious spell which lasted several hours. This spell was attended with very severe pain over the abdomen and all evidence of shock and hæmorrhage. She was seen by her local physician who recognized the condition

as a possible ruptured ectopic pregnancy. He prescribed quiet, cold packs, and remedies to combat the shock. On the next day the patient had somewhat recovered but was having periodic attacks of hard pain, which, if attended with the least exertion, caused fainting spells. She entered the hospital on the afternoon of that day with the following condition and physical findings.

Physical findings. The patient was a poorly nourished thin individual, markedly under the effect of opiates. She had had four quarter-grains of morphine in the past 12 hours. There was a medium degree of pallor, no sighing respiration, or evidence of presence of shock as reported in her history. The pulse was 100; axillary temperature, 99.8. The chest was normal, abdomen much distended, apparently full of gas. There was much rigidity over the entire abdomen with no especial tender point. Bimanual examination showed the uterus slightly fixed and enlarged, no palpable masses could be determined either in the cul-de-sac or in the adnexa. The pelvic examination was unsatisfactory on account of the distention. The size of the uterus could not be accurately determined and the cervix had a soft feel. There was a free pus discharge from the cervix of thick creamy character with very little odor. There was no blood in the discharge.

Laboratory findings. Hæmoglobin, 65 per cent; red blood cells, 3,000,000; leucocytes, 25,400; differential count indicated polymorphonuclear leucocytes predominating; blood pressure was 126-72; urine, normal. Examination of the vaginal discharge revealed the presence of gonococcal infection.

Diagnosis. A tentative diagnosis was made of pelvic infection with peritonitis first, ruptured tubal pregnancy second.

Conduct of case. The patient was put in the charge of a special nurse with instructions to follow the pulse and report accurately on the general condition. During the afternoon the patient suffered one fainting spell at which time the pulse reached 120, but remained of good quality. The temperature in the evening reached 100-6. On the second day the patient seemed improved; a repeated vaginal examination gave the same findings as previously recorded. At times there was some slight bloody discharge from the uterus, never any bulging in the cul-de-sac.

The only treatment employed was cold packs to the abdomen and sterile hot douches once daily and enemas for gas. The progress of the patient during the next 12 days was one of gradual improvement. For 3 days prior to the operation, the temperature had remained normal and the pulse had followed a range from 84 to 90. The abdomen had become considerably less rigid and was not painful on palpation. Bimanual examination showed the uterus fixed with a more prominent firm mass in the right side of the pelviv, closely attached to the fundus uteri, and the cersix was more firm than on first examination. There had been an occasional slight bloody discharge and a considerable lessening of the purulent discharge. The blood examination showed 14,000 leucocytes and a slight increase in red cells. The blood pressure was 115-70. The patient was feeling very much better and demurred somewhat on accepting surgical treatment. The operation was performed April 7 under ether anæsthesia.

Operative findings. A median incision was made. The peritoneum was considerably discolored, giving evidence of hæmorrhage in the abdominal cavity. Quite dense lines of omental adhesions were found along the site of the previous operation which had been a right median incision. After these and the newer recent adhesions were loosened, a large quantity of clotted blood was removed. Great care was taken not to severely traumatize the coils of intestine which had been sealed together and to the uterus with the clotted defibrinated blood. Probably a pint of blood serum was sponged from the abdomen. After the adhesions were freed, the tubes were carefully visualized and it was noted that there was a rupture of the right tube at the cornu of the uterus, from which there was some oozing of bright blood. The procedure determined upon was a subtotal hysterectomy. This was done in the usual manner. The left adnexa, which was apparently normal, was left in place. A glass drainage tube from the cul-de-sac was used and the usual closure made. The time consumed in the operation was 40 minutes. The period of her recovery was uneventful and she was dismissed from the hospital in 18 days.

Examination of specimen removed (Fig. 1). The gross specimen as photographed shows the uterine body slightly larger than normal and of firm consistency. On the left, the fundus is of normal shape and none of the adnexa is attached. On the right side, there is a mass about the size of a small lemon bulging out from the fundus. On the posterior surface the peritoneal coat is smooth and unbroken. On the anterior surface there is a roughened condition of the peritoneal coat evidencing adhesions and at a point on the anterior wall there is also evidence of the source of rupture. The right horn, where the mass appears, is considerably higher than the cornual region on the left. The mass is of about the same consistency as the fundus of the uterus. The tube on the right side is attached.

BIBLIOGRAPHY

1. Conrad. Zentralbl. f. Gynæk., 1923, xlvii, 1402.
2. Daniel. Surg., Gynec. & Obst., 1922, xxxiv, 15.
3. Di Palma. Surg., Gynec. & Obst., 1921, xxxiii, 2851.
4. Foskett. Am. J. Obst., 1916, 232.
5. Katz. Zentralbl. f. Gynæk., 1923, xivii, 1567.
6. Kelly. Operative Gynecology. New York, 1902,
7. Oastler. Ectopic pregnancy. Surg., Gynec. & Obst., 1917, xxiv, 224.
8. Schuman. Extra-Uterine Pregnancy, p. 17.
9. Ibid., p. 19.

THE SURGICAL TREATMENT OF GASTRIC AND DUODENAL ULCER[1]

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CONSIDERATION of the surgical treatment of gastric and duodenal ulcer presents two problems: First, which cases shall be treated surgically? Second, if operation is determined to be advisable, what surgical procedure shall be carried out? Each of these questions is still a matter of disagreement or rather argument; the former, between the internist and the surgeon, while the latter, concerning the relative value of different operations, is as yet far from being agreed on among surgeons. In fact, during the past year in three papers read before the New York Surgical Society three different surgical procedures were considered. Possibly the difference in specific conditions encountered prevents any standardization which might simplify the problem.

One reason for the lack of unanimity of opinion as to the first question is the fact that each surgeon bases his opinion on his own limited number of cases. Of a number of patients treated by operation, a certain percentage for various reasons have recurrence of symptoms. Such patients consult the internist who sees a few of these patients but does not see those who have been cured and of course is impressed by the number of uncured surgical cases and therefore argues against surgery. On the other hand, the surgeon rarely sees patients who have not been treated for varying periods more or less adequately by the internist. W. J. Mayo has said that his idea of the time to operate on a gastric or duodenal ulcer is after it has been cured nine times by medical treatment. Scudder states that in a series of cases operated on at the Massachusetts General Hospital for gastric ulcer, the average term of medical treatment was between 5 and 10 years. Finney and Friedenwald give the average time of medical treatment before operation as 9 years.

Some of the elements which make it most difficult accurately to determine the end-results of medical treatment and the value of opinion based thereon are: The difficulty of certain methods of diagnosis, the characteristic periodicity of symptoms which often disappear spontaneously or under treatment only to recur, and the recurrence of symptoms or even perforation after patients have been discharged as cured. Many examples of these conditions are easy to cite. After the most careful history, clinical study, and X-ray examination on which a diagnosis of ulcer is based, an operation may fail to demonstrate the lesion. Such a case, if no operation is performed, would be classed as a cure or a failure to cure, of a gastric or duodenal ulcer; on the other hand, after the diagnosis of ulcer is made, at operation a diseased gall bladder or, I believe less frequently than is generally stated, the appendix may be found to be the cause of reflex stomach symptoms.

The natural inclination is to remember individual cases that are so striking as to remain in the memory, while the usual group makes less impression. I acknowledge that I may be unduly impressed by such cases as the following: A patient with duodenal ulcer was discharged from the hospital as cured after medical treatment and the ulcer perforated a few days later. Another patient, after careful roentgenographic examination and medical treatment, was referred to the surgical division for operation for ulcer. No ulcer was found, the lesion present being a cholecystitis. One patient entering the third Surgical division at Bellevue Hospital had undergone careful treatment for 8 weeks with the Lenharz diet in a hospital in another city and he brought a careful copy of the notes of his treatment. He was discharged cured. Four weeks later he was operated on in Bellevue Hospital and a large unhealed active ulcer found.

As an argument against operation, the internist cites cases in which the patient still complains of symptoms or of marginal ulcer as a post-operative complication. This latter does occur in a certain percentage of cases

[1] Read before the Kingston Academy of Medicine, Kingston, New York, Thursday, March 26, 1925.

following gastro-enterostomy, its frequency varying according to those making the report. It is also accepted that hæmorrhage may recur after gastro-enterostomy in 1 per cent of duodenal ulcer cases and 2 per cent of gastric ulcer (Balfour); but it is to be remembered that hæmorrhage occurs in less than 25 per cent of chronic ulcer cases. In most cases in which no ulcer is present hæmorrhage is due to superficial erosions caused by toxic hepatitis, a result of focal infection (Mayo). Or it may be due to cirrhosis of the liver, splenic anæmia, or other causes.

The incidence of gastric carcinoma, whether it is believed to result from the degeneration of the edge of a chronic ulcer, or to have existed from the start as a carcinoma which is indistinguishable either before operation or on the operating table, is another argument in favor of surgical treatment of gastric ulcer. Great difference of opinion still exists as to the frequency of the degeneration of gastric ulcer into gastric carcinoma. This has varied between the figures of 70 per cent in the original reports of several years ago from the Mayo Clinic, to less than 2 per cent, according to the figures of Wilenski. It is certainly of significance, however, that the cases studied by an actuary of one of the large insurance companies showed that the life expectancy after operation for duodenal ulcer was the same as that of the normal population of the same age, while the death expectancy in cases operated on for gastric ulcer was three times as great. Balfour later revised his earlier figures on the degeneration of gastric ulcer into carcinoma, showing that a considerable number of the patients from the Mayo Clinic, operated on for gastric ulcer, died within such a short period after their discharge from the hospital that it is fair to assume that carcinoma was present at the time of operation. In a number of instances, subsequent, careful examination of specimens removed from these patients showed carcinoma in some portion of the ulcer. A study by von Eiselsberg of 41 late deaths after operation for gastric ulcer, in which 23 postmortem examinations were performed, showed that 13 were from carcinoma of the stomach. Also statistics of Joslin of the Massachusetts General Hospital showed that 24 per cent of the late deaths following gastric ulcer were from cancer of the stomach. Time does not allow here a further consideration of this subject which was more thoroughly analyzed in an article by me on "Carcinoma of the Stomach," published in 1919.

After all, facts are better than argument and the ultimate results of both forms of treatment may best be measured by a study of the end-results of not one, but several large groups of cases. This is extremely difficult except by a long continued, persistent, and careful "follow-up" because of the known periodicity of symptoms and frequent amelioration of all signs of indigestion in the patient whose ulcer either becomes quiescent or else clears up only to recur.

A large number of reports from the medical clinics where the "follow-up" has been continued over a long period are more difficult to obtain than surgical reports. A considerable number, however, have been published within the past few years. Sippy stated that he cured 85 per cent of cases of pyloric obstruction of all grades due to ulcer by his method and that only one-half of the remaining 15 per cent needed operation. Brown states that the advocates of both surgical and medical treatment claim a cure of from 75 to 90 per cent of ulcers, but says that certainly this number is not really cured by either medical or surgical procedure. Eggleston reports on 156 cases which have been treated medically and have been free from symptoms for a period of 3 years. One hundred and thirteen, 72 per cent, reported no return of symptoms, and 43, 28 per cent, reported recurrence. In this report 80 per cent were ideal cases for medical treatment in that the patients were well nourished, had no pyloric stenosis, and had no indications of a tendency toward perforation.

Several reports have been made as to the end-results of surgical treatment. Mayo states satisfactory results were obtained in 85 per cent of gastric ulcer and in 90 per cent of duodenal ulcer cases without excision. Ninety-five per cent were cured surgically but more than one operation may have been necessary in 1 or 2 per cent of the cases. The

mortality was under 2 per cent in all cases. More recently Balfour, reporting on 1,000 cases, all operated on 10 or more years ago, states that 88 per cent were cured and that there were only 3.5 per cent of recurrences. Finney gives end-results of gastro-enterostomy as 77.2 per cent of cures with 88.6 per cent of complete cures by means of pyloroplasty. Pool reports 50 patients well out of 59 cases followed up after gastro-enterostomy, 84 per cent. Deaver gives 80 per cent entirely well and 10 per cent markedly benefited but having occasional digestive upsets due to indiscretions of diet. Scudder's analysis of 108 cases of chronic gastric ulcer showed 99, 91.7 per cent, well; of 94 cases of duodenal ulcer, 88 well, 93.6 per cent. The most recent English statistics quite closely correspond to American. Moynihan reports cures in 90 per cent of his cases. Sherren, reporting on 500 cases, states that 92.6 per cent were well 2 or more years after operation. Walton, in 114 cases, reports 85 per cent cured and 10 per cent improved.

Examination of the cases of gastric ulcer operated on by the various members of the Surgical Staff of St. Luke's Hospital, New York, from June 1, 1918, to October 1, 1924, the period during which the follow-up has been in operation, showed a total of 68 cases operated on by gastro-enterostomy with excision or cauterization of the ulcer or both. The operative mortality was 7.5 per cent, 5 cases, or if 1 case operated on for perforation be excluded, 5.8 per cent. One patient died 2 years after operation from carcinoma. Eleven cases could not be traced. There were, therefore, 52 cases followed. Of these 48, 92.3 per cent, were reported cured, 3, 5.3 per cent, improved, and 1, 2.4 per cent, failure. The causes of death, exclusive of the case of perforation, were in 2 cases pneumonia, in 1 uræmia, and in 1 profound anæmia. In addition to the 68 cases treated by gastro-enterostomy, there were 14 cases of gastric ulcer treated by pyloric or midgastric resection with 1 death (6.7 per cent), 1 case we lost track of, and the 14 remaining patients were cured or made no complaints.

The records of 144 cases of duodenal ulcer operated on during the same period at St. Luke's Hospital showed 15 deaths, 10.2 per cent, but of these 15 deaths, 5 followed operation for perforated ulcer, 1 died from pernicious anæmia, and 2 were associated with lesions of the biliary tract, 1 of which showed cholelithiasis and cholecystitis, the other common duct obstruction. If these be excluded the mortality was 5.8 per cent. Of the 100 cases followed, 90 per cent are reported cured. Five were improved but had some symptoms after indiscretions in diet. Five patients, 5 per cent, were unimproved.

However, there are a number of surgeons, particularly those in Europe, who for several years have been dissatisfied with the results of excision and gastro-enterostomy and have reported very different results from their operations.

Finsterer, of Vienna, during a visit to this country in the fall of 1923 quoted the following statistics; Payr had in his material 62 per cent recoveries and 38 per cent failures; Bier 66 per cent and Haberer 37 per cent recoveries.

Many reports from the French clinics also show unsatisfactory results. The series of statistics giving the worst results after gastro-enterostomy for the treatment of duodenal ulcer, published by an American surgeon, are those of Lewisohn, in SURGERY, GYNECOLOGY AND OBSTETRICS, January, 1925. He reports that examination of 68 cases 4 to 9 years after operation showed 47 per cent completely cured and 19 per cent with a fair result. Thirty-four per cent of the patients had gastrojejunal ulcers. In 12, 18 per cent, a second operation was performed. In 11, 16 per cent, the diagnosis was based on clinical symptoms and X-ray findings. The mortality in 213 cases of all kinds of stomach operation for the period from 1915 to 1920 was 22, 10 per cent plus.

This latter group of statistics is the basis for the advocacy of the more radical operations such as subtotal gastrectomy and the many other types of operation which have been suggested during the past few years and which will be considered when the choice of operation is discussed.

It is generally conceded that acute perforation, marked stenosis, and most of those

ulcers of the stomach which are of the penetrating type, call for surgical treatment. It is very likely that those cases in which a large deforming ulcer of the body of the stomach exists have little prospect of cure by other than surgical means. Surgery should not be used in acute cases, or in those with a short history or a history of never having had the benefit of adequate proper medical treatment. A gastric residue does not necessarily mean an organic stenosis of the pylorus, as reflex spasm and œdema may be a large factor in causing the retention, and this may often be relieved by medical means. And in most instances this should be attempted. But it would appear that a large percentage of these patients is relieved, not cured, and the symptoms will recur.

The operative mortality is, of course, advanced as an argument against surgical treatment and justly so, but the operative mortality in uncomplicated cases of duodenal ulcer is small. Mayo reports 1 to 2 per cent; Crile, in cases of simple gastro-enterostomy alone, less than 1 per cent; Scudder in 171 gastric ulcer cases reports a mortality of 7.6 per cent; in 139 duodenal ulcer cases, 6 per cent (but does not state whether this included cases of perforation); Pool, in 70 cases, 7 per cent, but it is not more than fair to state, that of the 5 deaths, 1 was due to delirium tremens and 1 to septicæmia following mastoiditis. The operative mortality in the St. Luke's series has already been given.

The death rate following the more extensive operations such as resection, transgastric or midgastric, and the various types of pylorectomy one would expect to be higher. But the type of cases requiring such operation are just the ones in which the prospect of cure by medical treatment is least, the symptoms most severe, and the possibility greatest of the presence or the development of carcinoma. In such cases also must be considered the danger of perforation, even while one acknowledges that perforation may frequently occur from an acute pathological process, without the previous existence of an old chronic indurated ulcer. In the hands of the skilled gastric surgeon, even these more radical operations show a surprisingly low mortality. Haberer has published a report of 256 Billroth I operations or modifications thereof for gastric and duodenal ulcer with a 5 per cent mortality; while in resection for duodenal ulcer Friedman reports a 2.6 per cent mortality in 115 cases, and Finsterer 3.6 per cent in 272 cases.

Solution of the second problem, the choice of operative procedure, cannot be accomplished by the theoretical establishment of an ideal procedure and the effort to attain that ideal. Lack of knowledge of all of the etiological factors entering into the cause and recurrence of ulcer prevents the determination of an exact cure. In duodenal ulcer, gastro-enterostomy, even if not ideal, has been acknowledged by most American surgeons to be a successful method of treatment. If the ulcer is in the anterior wall, it may be excised or cauterized and possibly the small number of hæmorrhages occurring after gastro-enterostomy lessened. But even this is uncertain. In 1 case of perforated ulcer operated on about 4 years ago in which the edges of the perforation were excised, the perforation carefully closed, and the area infolded and a gastro-enterostomy performed, a rather severe hæmorrhage subsequently occurred, but this was found to be due to a jejunal ulcer. In 2 other patients operated on about the same time, both of whom had developed severe hæmorrhages before operation, and in 1 of whom two transfusions were necessary before operation, nothing but gastro-enterostomy was done; both were perfectly well and had no recurrence of any symptoms when seen recently. In the ulcers of the posterior wall, those which are most prone to bleed, excision, of course, is not practical.

Gastro-enterostomy, however, has fallen into more or less ill repute. I do not believe this is deservedly so. Of course if not properly placed, if too large, if the distance from the duodenojejunal junction is too long, or so short as to produce tension or allow kinking or angulations, if the edges of the anastomosis are not carefully sutured, the maximum physiological function will not be attained. I have seen a gastro-enterostomy so large that everything entering the stomach practically fell into the jejunum. Of course, under

such conditions, it is reasonable to expect intestinal indigestion. Much has been written of the liability of the gastro-enterostomy stoma to close, particularly if the pylorus remains patent. In none of those gastro-enterostomies done at St. Luke's Hospital has the stoma been known to have failed to remain patent. However, in the case of a patient who had been operated on 5 years previously in another city, I found the stoma closed although the pylorus was also tightly occluded. However, it must be a very rare occurrence. It is my belief that by far a more common source of postoperative trouble is that too large a stoma allows too rapid emptying of the stomach contents. A series of 14 cases checked up at varying times after operation in the X-ray department of St. Luke's Hospital by Dr. Le Wald 2 or 3 years ago would seem to verify this opinion.

A very interesting suggestion as to the failure of gastro-enterostomy to cure ulcer or to function properly is that advanced by Devine before the meeting of the American College of Surgeons in 1924 and published in SURGERY, GYNECOLOGY AND OBSTETRICS in January, 1925. He postulates that the cure of the ulcer and relief of symptoms depends on the proper neutralization of the hyperacidity by regurgitation of the alkaline intestinal juices and states that two mechanical causes may prevent this. Either a spur formation occurs at the gastro-enterostomy stoma which directs all the flow into the stomach, or an axial twist of the intestine at the point of anastomosis prevents a sufficient regurgitation or proper drainage.

It has been generally stated in the American literature that gastrojejunal or jejunal ulcer followed gastro-enterostomy in 1 to 3 per cent of cases. In the German literature this was estimated to occur in from 5 to 10 per cent of cases and now Lewisohn has reported as previously stated 34 per cent. This number of gastrojejunal ulcers and the reported poor results from the foreign clinics caused the advocacy of more radical treatment of duodenal ulcer. Haberer was one of the first to use extensively the method of pyloric resection for duodenal ulcer, performing the anastomosis, a gastroduodenostomy, by the modification of the Billroth I method. This procedure was adopted by many European surgeons. Finsterer, however, stated that this was followed by many recurrences, and in his lectures 18 months ago said that already 29 recurrences of ulcer had been observed. He therefore advocated and practiced a resection of two-thirds to three-fourths of the stomach for duodenal ulcer with an anastomosis by the Pólya method.

When the ulceration of the duodenum is situated so near the papilla of Vater or is so extensive that removal of the duodenum is impractical, he divides the stomach proximal to the pyloric muscle, resects the antral portion of the stomach and anastomoses the remaining portion to the jejunum.

Many other methods have been suggested of avoiding gastro-enterostomy. The Finney method of pyloroplasty has stood the test of many years but cannot be done if the duodenum cannot be mobilized. C. H. Mayo has recently suggested a modification of the Finney method. Erdmann has recently reported on 50 cases of pyloroplasty done by the Horsley method with 90 per cent of cures. It is of interest to note that Erdmann reports an increasing number of cholecystectomies in the last of this series of cases.

It is extremely difficult to reconcile the statistics of those advocating the very radical operations for duodenal ulcer because of the frequency of gastrojejunal ulcer and other bad results, with those still adhering to the less radical measures. I feel that I am expressing the opinion of all of the surgical staff at St. Luke's hospital where this class of patients have been carefully followed during the last 5½ years in the figures here given which are a fair expression of the belief that these results are too favorable to justify the radical operation of subtotal gastrectomy for duodenal ulcer. These radical operations are based on the theory that only by removing the hyperacidity can ulcer be cured, and that while the acid forming glands are in the fundus of the stomach, resection of the pyloric two-thirds removes the hormone which stimulates these glands to action. Finsterer states that hyperacidity is greater in duodenal than in gastric ulcer cases.

While the mortality from these radical operations in the hands of the skilled gastric surgeons have not been very large, it must be, that if the surgeon not doing many such extensive resections adopts this method, many more cases will be lost than if a less radical procedure were followed. And it is also my belief, that perhaps the end-results following these radical procedures, if followed over the long period that gastro-enterostomy with or without excision or the methods of pyloroplasty have been followed, may not justify the increased danger and be entirely free of any and all unpleasant sequelæ.

In the operative treatment of gastric ulcer the excision of the ulcer, if large, is the ideal to be attained. If the ulcer is in the pyloric region, excision may best be done by a pylorectomy after the Pólya Balfour or the older Billroth II method. The former is easier, more rapid, and gives better functional results. In a recent article Woolsey especially favors this type of operation and our statistics at St. Luke's show the lower mortality and good end-results after the Pólya Balfour resection. It is my belief that a small enteroanastomosis between the limbs of the loop below the point of anastomosis will improve the results of the Pólya operation. Some of these large indurated ulcers cannot be distinguished from carcinoma at the pylorus, and I have in 3 instances done a pylorectomy for what I believed to be carcinoma, the microscopical examination showing no carcinoma cells in a large greatly indurated ulcer.

If the ulcer is small on the lesser curvature near the pylorus, excision with the knife or cautery or the Balfour method of cauterization plus gastro-enterostomy has given the best results according to our statistics. I do not believe that excision alone without gastro-enterostomy will cure most of these patients. Strauss has recommended the resection of the lesser curvature of the stomach in such cases, combined with a removal of a considerable portion of the pyloric muscle to shorten the emptying time and allow regurgitation into the stomach. With this procedure I have had no experience.

Small ulcers of the posterior wall may be excised by the transgastric method, but in the case of larger ulcers of the lesser curvature and posterior wall, the midgastric or sleeve resection is the operation of choice. This applies particularly to those cases in which the ulcer is situated at such a distance from the pylorus that a pylorectomy is not indicated and in which the stomach is of the hourglass type. Contrary to some reports, these patients usually do well, with relief of symptoms, and although the hourglass deformity may sometimes partly return as shown by follow-up roentgenographic examinations, they rarely show the retention present before operation.

Those ulcers situated high up on the lesser curvature, often of the penetrating type, sometimes adherent to the liver, are most difficult to deal with. In 2 cases of my own, a resection of the adherent portion of the liver which formed part of the base of a large ulcer, allowed a pylorectomy in one instance, and a midgastric resection in another. In both instances the lesion was believed to be carcinoma, the hæmorrhage from the liver was easily stopped by means of suture, and both patients recovered. In some cases, however, the adhesions are so dense that the lesser curvature cannot be freed, and in such, the choice of procedure lies between a gastro-gastrostomy and a gastro-enterostomy. In one patient of mine with such a condition, symptoms of ulcer having been present for 16 years, the patient was greatly relieved although not entirely cured of occasional symptoms by a gastrogastrostomy. This patient was reoperated on 2 years ago, the X-ray showing obstruction in the descending colon as well as gall stones. There was an inflammatory band obstructing the colon, and division of this band, together with cholecystectomy, relieved the symptoms. The stoma between the gastric pouches remained of good size and functioned well.

For high ulcer of the lesser curvature, gastro-enterostomy theoretically, should cause little benefit, and this statement is made in most articles on gastric surgery; but excision is most difficult and it is of much interest to note that in 3 cases of such nature in the list of cases analyzed from St. Luke's Hospital, this seemed to be the only possible

procedure and the follow-up shows all these cases relieved of symptoms. In 1 patient with the lesser curvature and posterior stomach wall so adherent or indurated that posterior gastro-enterostomy could not be done, an anterior gastro-enterostomy with an entero-enterostomy has caused complete relief of symptoms more than 2 years later. Rarely one meets with a stomach lesion in which the pathological condition is such that resection on account of extreme ulceration and adhesions presents insurmountable difficulties without greatly endangering the life of the patient, and even a gastro-enterostomy seems impractical. In such cases a jejunostomy may give the ulcer time to heal and either allow a cure or a second operation when necessary. Moynihan has advocated this method of treatment either alone or with an anterior gastro-enterostomy; and in 1 case from the St. Luke's series in which the jejunostomy was left open for a year a large increase in weight with a marked improvement of the stomach lesion has resulted, and now 2 years later the patient is symptom free.

In the treatment of acute perforation it is now generally conceded by most surgeons that closure of the perforation with or without excision of the ulcer and without an accompanying gastro-enterostomy is the operation of choice. If the perforated ulcer is at or near the pyloric ring, an excision followed by a pyloroplasty after the method of Horsley has given excellent results.

We will probably never cure 100 per cent of our ulcer patients either by medicine or surgery, unless we can know all the factors which enter into the etiology and remove all the causes of ulcer. In one of my cases I excised an ulcer of the lesser curvature but did not do a gastro-enterostomy. Symptoms recurred after 2 years, and at a second operation a duodenal ulcer was found. A gastro-enterostomy was done and the patient has been well since, over a period of 6 years. Patients who develop gastroduodenal, marginal, or jejunal ulcers after gastro-enterostomy, are apt to develop ulcer again after a second or even third or fourth operation. Resection of the stomach after the Pólya method seems to be indicated in these cases.

Many years ago Rodman advocated pylorectomy for chronic ulcer to remove the ulcer bearing area, but Cole and Hoguet have reported a large marginal ulcer after a Pólya operation and Lewisohn 3 cases following Billroth II operations, while the 29 cases reported by Finsterer after the Haberer operation have been mentioned already. Of course the advocates of the radical operation for duodenal ulcer are equally radical in the case of gastric ulcer, and it would seem to me with better reason. But that three-fourths or more of the stomach should be removed for a small ulcer of the lesser curvature or anterior wall of the stomach, or for a duodenal ulcer, still appears to me a question to await final decision for the reason I mentioned in discussing the treatment of duodenal ulcer.

Therefore, to attain the best possible results, it is necessary, in addition to the best operative procedure, to carry out as careful after-treatment as to diet, and so forth, as the patients themselves will allow. Treatment should also be given before, at the time of operation, and afterward, in an effort to remove or prevent those foci of infections which are most probably factors in the etiology of the patient's lesion. It has been my observation that most of the patients who have unsatisfactory results after operation complain of persistent constipation.

It has been stated that about 50 per cent of the mortality following gastric operations is due to chest complications, and therefore our mortality will be lessened materially by careful pre-operative treatment, the avoidance of operation in the presence of a beginning cold or coryza or sore throat, cleaning up a dirty mouth, teeth, or tonsils before operation, and the use of a local anæsthetic in bad risks.

SUMMARY

I. Choice between medical and surgical treatment.

1. If the case is acute, or in the presence of acute hæmorrhage, medical treatment should be tried first and given every opportunity to cure the patient.

2. Operative procedure should be employed after medical treatment has failed: when there are repeated hæmorrhages, when

the patient has recovered from one severe hæmorrhage, when the X-ray shows marked deformity particularly in gastric ulcers, and when the condition has been present for a long time.

II. Choice of operative procedure.

1. Gastro-enterostomy with or without excision, and the various method of pyloroplasty are not ideal procedures because they do not remove all the etiological factors of ulcer.

2. According to most of the American and English statistics the average percentage of cures is in the neighborhood of 85 to 90 per cent.

3. Sometimes the complications of jejunal ulcer may be worse than the original lesion.

4. Although the continental statistics and the percentage of cures of a few American surgeons show unfavorable results after gastro-enterostomy with or without local excision, our follow-up at St. Luke's Hospital, New York, and most American statistics do not appear to justify radical gastric resection for duodenal ulcer or small gastric ulcer.

5. Careful technique, pre-operative preparation, and after-care of the patient will lessen the mortality and increase the number of cures without radical operation.

RESECTION OF LONG BONES FOR CHRONIC OSTEOMYELITIS

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THE management of osteomyelitis is probably one of the most discouraging aspects of the practice of surgery. The disease so resists treatment that the unfortunate subjects undergo large numbers of operations without eventual cure, and often carry discharging sinuses throughout a long period of their lives. Resection of the diseased bone has been advocated by several, but apparently has not been generally accepted.

In 1920, in the course of performing a sequestrectomy for chronic osteomyelitis, we did an actual resection of the shaft. While the healing and regeneration were not good in this case (Case 1), it presented the possibilities of the method, and further resections for chronic osteomyelitis have been performed. We have resected portions of the long bones in 23 patients with a total of 28 resections. The results have encouraged us in the belief that this method may be a cure for chronic osteomyelitis, in children at least.

Since the monumental work of Ollier in 1867 it has been known that the periosteum is capable of completely regenerating a new diaphysis. His results were not of the best because he did not distinguish between tuberculous and infectious lesions and because antisepsis had not been developed. Cheever (3) in 1870 was the first in this country to report operations in accordance with the principles laid down by Ollier. Nichols (7) in 1898 carefully described a method for the successful removal and regeneration of the diaphysis. He advised the subperiosteal resection of the shaft at about the eighth week after the subsidence of the acute process, that is, at a time when the periosteum had begun to form bone but had not yet formed a rigid tube. The periosteal cavity, lined with a thin shell of bone, was then disinfected with 95 per cent carbolic acid followed by alcohol, the inner surfaces of the tube approximated and the edges sutured with chromic catgut. The skin and muscle were closed over the periosteum leaving small gauze or catgut wicks for drainage. Bone formation was palpable at the third week and went on to good functional results. Eight of the eleven cases reported in 1904 attained perfect results, and the others were fair.

Our resections have been performed, with one or two exceptions, upon cases of chronic osteomyelitis which have had discharging sinuses from 4 months to as many years. The technique has been to resect as much of the diaphysis as has been diseased and to sew the periosteal edges together over perforated rubber drainage tubes, allowing the tubes to protrude from either end of the incision. The tubes have varied in size from the ordinary Dakin's tube to a large tube ¾ inch in diameter. The large tube was used in but a few cases. Dakin irrigations have then been carried out by means of the tubes, and they have been allowed to remain for 2 to 5 weeks, depending upon the duration and character of the discharge. Regeneration of the bone has proceeded in most cases with surprising rapidity and the patients have attained a complete functional cure with but little deformity of shortening. There have been some failures of regeneration and these will be discussed with the presentation of the cases. The patients are kept in bed with extension for 8 to 10 weeks, then allowed to walk with crutches and a cast or brace till the sixth month, and then allowed partial weight bearing with brace or cast till the eighth to tenth month.

Case 1. J. P., a girl of 13 years, entered the hospital in March, 1920, with a 6 months' history of swollen painful knee following incision and drainage of acute inflammation of the lower end of the left femur. Examination showed the left thigh atrophic, with the knee fixed in flexed position, fixed patella, fluctuation of the joint capsule, and two discharging sinuses in the posterolateral aspect of the lower end of the thigh. Operation was performed and the lower end of the femur found to be a mass of sequestra, their removal resulting in a resection of the lower end of the femur. The periosteal cavity was packed with gauze and the leg placed in a hip spica cast. After the subsequent opening of abscess cavities 1

Fig. 1.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 3.

Fig. 1. Case 2. Note the involvement of the tibia from one epiphysis to the other. The entire diaphysis was resected, and lifted out of the periosteum with little effort.

Fig. 2. Case 2. Showing the marked bony involvement of the right femur before operation, also fracture from attempted reduction of dislocation of hip.

Fig. 3. Case 2. Showing the extent of the resection of the femur, about 6 inches.

and 2 months later, respectively, healing and regeneration of the bone progressed with final cessation of the discharge about 18 months later. Two years after the operation the femur was found to be much bowed anteriorly probably because traction was not used, and too much reliance had been placed upon the cast. The knee was ankylosed and the foot in equinus position. A tenotomy of the Achilles tendon was performed and a month later the patient fell while wearing a cast fracturing the regenerated portion of the femur. Union occurred rapidly and now, 4 years after the operation, the patient is walking well without pain, without discharge, and with 2¾ inches shortening.

The progress of this first case does not sound alluring, and yet the result has been much better than after many less radical procedures.

CASE 2. I. O., a white boy of 9 years, injured the left foot on a nail in September, 1920, the wound becoming infected and being incised at a hospital. Two months later osteomyelitis developed in the left tibia which was incised and drained. After another 2 months pain developed in the right hip and the X-ray showed dislocation which was reduced under anæsthesia but soon recurred. Six months later, in March, 1921, he entered Lakeside Hospital presenting dislocation of the right hip with osteomyelitis of the femur, two sinuses over the left tibia, one over the left fibular head, and a small nodule over the head of the second right metacarpal, which 3 or 4 months before was tender and reddened but had receded spontaneously. The patient was in very poor general condition, with marked toxic manifestations. Attempt at reduction of the hip resulted in fracture of the femur. Three weeks later incision over the left tibia showed the bone to be so badly diseased (Fig. 1) that the entire shaft could be lifted out with very little effort. At intervals thereafter incision and curettage of the following sites was performed: head of left fibula, head of the right second metacarpal, and right internal malleolus. In August, 6 inches of the lower end of the right femur was re-

sected (Fig. 3). By this time a rather well-marked foot-drop had developed as a result of injury to the peroneal nerve while the head of the fibula was being curetted. In January, 1922, suture of the peroneal nerve was performed and in September of the same year, two years after the original injury, the patient was walking without aid, presenting some degree of foot-drop, ½ inch shortening of the left leg, some limitation of movement of the right knee, and almost complete fixation of the right hip. In March, 1925, the patient is walking ½ mile to school and there are no signs of infection anywhere. The femur and tibia (Figs. 4 and 5) have reformed strikingly, although there is a 2 inch shortening of the left leg, the leg in which the tibia was resected, the femur being resected in the right. The shortening is apparently due to destruction of the distal epiphysis, for both were somewhat involved and the resection included the entire diaphysis.

CASE 3. R. M., a white female, developed an infection of the left foot at the age of 4 years, which was incised by a physician, with the evacuation of pus. There has been extension of this process over the body until she presents, on admission to the hospital 3 years later on March 30, 1921, three sinuses over the left clavicle, two at the upper end of the left humerus, one over the right forearm with extensive scarring and deformity of the wrist, one over the upper end of the left femur, and great thickening of the left ankle. The child had a most severe osteomyelitis and was in very poor condition. The following operations were performed: April 15, incision and drainage of the left femur; April 16, removal of sequestra from the left clavicle and left humerus; April 29, resection of the right ulna; May 6, resection of the entire left femur, neck to the condyles; June 17, incision and drainage of abscess of left thigh; June 29, incision, drainage, and curettage of left mandible; July 25, resection and curettage of the left tarsus. About a year later, all wounds had closed, the femur had entirely regenerated, the ulna had failed to regenerate, and the patient was leading an active normal life. In January, 1924, she fell and struck the right hip and developed pain, swelling, and redness. This subsided but reappeared in April and the X-ray showed complete destruction of the head with dislocation of the trochanter upward (Fig. 6). This was undoubtedly an old process. The abscess was incised and drained but no connection was found with the bone or joint. Three weeks later a good sized abscess was discovered under the scar over the left humerus. This was incised and drained without there being any apparent communication with the bone. Both wounds healed promptly, and hence, 4 years after the first resection, the patient presented complete regeneration of the left femur (Fig. 6), with all motions of the hip joint free, with good motion at the knee, and with considerable shortening which is admittedly much less than it would have been had there not been the dislocation of the head of the right femur. The right ulna partially is absent, the left humerus is solid but irregular, and the left clavicle has completely regenerated. There is slightly exaggerated mobility of the right elbow and wrist, and the left foot is in slight valgus.

It should be stated that these resections were operations of necessity and not of choice. The practical results, both healing and functional, have been excellent. It is noteworthy that the reappearance of the disease after 2 years of entire freedom was not in the bones that had been resected and that the origin was probably in the left humerus which had been merely saucerized. The failure of regeneration of the small bone was seen here to be associated with the resection of the larger and better nourished bone, the femur.

CASE 4. M. M., age 10 months, entered the hospital with several discharging sinuses over the left upper arm and with much tenderness along the whole length of the humerus. The disease began at the age of 2 months and the only operations had been small incisions for the escape of pus. There was almost complete ankylosis of the elbow joint, but supination and pronation were good. Four days later, April 25, 1921, incision was made over the lateral aspect of the arm from the shoulder to elbow and almost the entire shaft of the humerus found to be much diseased and was accordingly removed with little difficulty. The periosteum was packed open with iodoform gauze and the arm placed in an extension apparatus. Two months later the X-ray showed beginning bone formation. Extension was removed at about 6 months and progress seemed good until 10 months after the operation when a fracture was noticed, there being no history of violence. Four months later union was good, there was fairly good motion at the shoulder, but still almost complete ankylosis of the elbow. Now, 4 years later, he has a firm bone with 1½ inch shortening and moderate deformity. He has no sign of infection and has had no more fractures. Function is as good as could be expected with almost complete ankylosis of the elbow. The X-rays show a solid thick humerus with no deformity except at the extreme lower end which is very irregular. This, together with the fact that he had a pyogenic arthritis, accounts for the stiff elbow.

CASE 5. E. R., a white male, was operated upon for acute osteomyelitis of the right femur and tibia in 1920 at the age of 3, and a second operation was performed 6 months later at the same sites. He entered Lakeside Hospital 1 year after the onset of the disease presenting discharging sinuses over the leg and thigh, with thickening of the femur and tibia. In July, 1921, the entire diaphysis of the right tibia was resected and a month later the upper two-thirds of the femoral diaphysis of the same side. At the

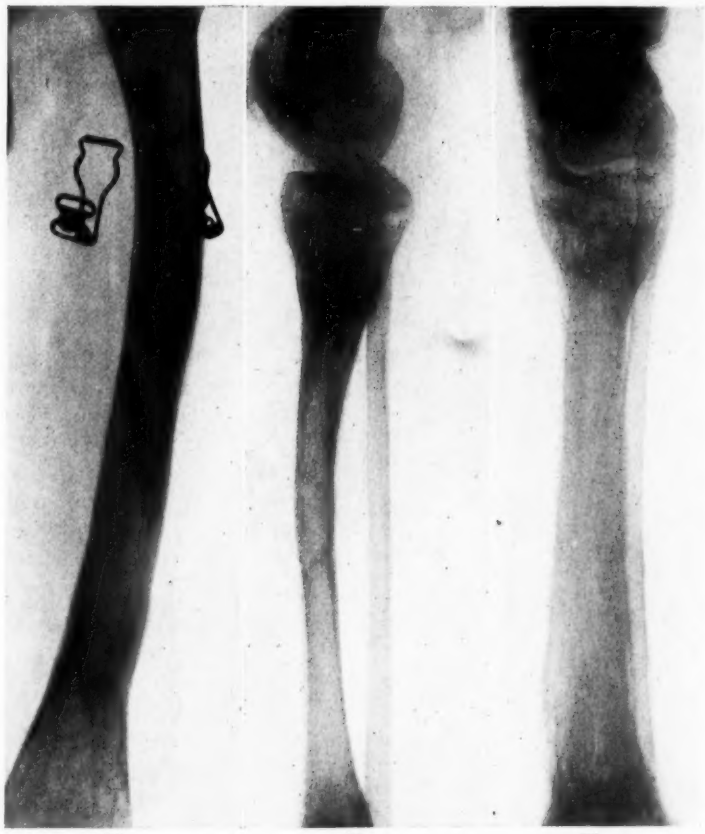

Fig. 4. Fig. 5. Fig. 5.

Fig. 4. Case 2. Showing right femur 4 years after resection of about 6 inches of shaft. Note apparent medullary cavity.

Fig. 5. Case 2. Four years after the resection of the left tibia. Note the apparent medullary cavity.

end of 16 months there was some discharge from the region of the left hip and removal of a small sequestrum was performed. The femur had regenerated to the size of the original bone but there was absence of the mid-portion of the tibia (Fig. 7). The boy has walked very well with the aid of a brace and there has been no evidence of infection for 2 years. There is ankylosis of the hip with 1¾ inches shortening of the right extremity. The fibula has been grafted into the tibia (Fig. 8).

It is interesting that these two cases of non-regeneration have occurred in patients in whom the femur was resected soon after the resection of the small bone. The question is whether or not these bones would have regenerated if there had not been regeneration of the larger bone with a better blood supply going on synchronously. However, we have other cases of non-regeneration of the tibia when it was the only bone resected. It has been the experience of other workers that the tibia, while favorable for resection in that it has the adjacent fibula for a splint, does not always regenerate, probably because it is endowed with a relatively poor blood supply. The occasional failure of union in osteotomies of the lower end of the tibia is likewise usually attributed to the fact that the nutrient artery of the tibia extends proximally from its

Fig. 6. Case 3. About 3 years after the resection of the left femur and just before the drainage of the abscess of the right hip. The deformity and shortening are apparent. The anatomical result in this case has been very poor, but the functional and therapeutic results quite good.

entrance at about the junction of the middle and lower thirds.

CASE 6. G. G., a white male, entered the hospital in February, 1921, at the age of 3, with abscess of the right hip, which was incised and drained. In September the process had again become acute and the entire upper half of the right femur was resected, with the evacuation of large amounts of pus. Subsequent abscesses required incision during the next 2 months. In October, 1924, he presented a solid femur with but ½ inch shortening with flexion of the hip to the right angle, good adduction, fair abduction, good rotation and all scars healed solidly.

CASE 7. J. S., a white male, age 10 years, entered the hospital in November, 1920, having had incisions made over acute inflammatory processes in both tibiæ about a year before, with incision and curettage at a hospital in another city 6 months before. He presented discharging sinuses over the lower halves of both tibiæ, and the ankles were swollen and of limited motion. There was an apparently healed sinus under the right clavicle. Both tibiæ were carefully curetted, the right healed well and a small sinus persisted in the left. A year later the process in the right clavicle reappeared and the entire clavicle was resected subperiosteally. Four months later all sinuses were healed, but in another month there developed an acute osteomyelitis of the external condyle of the left humerus, with involvement of the elbow joint. This was incised, drained, and healed with normal joint motion. The process in the left tibia then lighted up, and the entire diaphysis was resected, it being necessary to

Fig. 7.

Fig. 7.

Fig. 8.

Fig. 7. Case 5. Two and one-half years after the original resection. The patient walked about well with the aid of a brace and is now undergoing operation for bone graft of the fibula into the tibia ends.

Fig. 8. Case 5. Showing fibula grafted into ends of tibia.

curette the talus with the establishment of a sinus through the epiphysis. The wound healed completely in 2 months, and in 6 months the patient was walking without aid. Two years after the resection of the tibia, the patient returned complaining of pain in the leg and the X-ray showed an ununited fracture of the regenerated portion of the bone. There was slight evidence of inflammation which has disappeared on the application of a cast, and the union is now very firm. The ankle is ankylosed, and there is no evidence of infection in other bones of the body.

CASE 8. A. M., a white male, entered the hospital in November, 1921, at the age of 17 years. He had been operated upon twice before with saucerization procedures, the last time in 1916, and had remained entirely healed for 4 years. The X-ray showed osteomyelitis of the lower end of the femur, and that portion of the bone was resected. The progress was excellent, the patient walked with a cane in 4 months, and the discharge had entirely ceased in 8 months. Ten months after the resection the patient fell and broke the regenerated portion of the bone with opening of the old sinus. Eight months later the discharge had entirely ceased and there was good union, but

Fig. 9.

Fig. 10.

Fig. 9. Case 8. Ten months after the resection and immediately after the fracture, showing the width of the bone and the site of the fracture.

Fig. 10. Case 8. Nine months after the fracture to show the thickness of the femur. Undoubtedly the fracture is due to the poor shape of the bone which may have been caused by allowing the patient to walk without other support than a cane at the much too short interval of 4 months after the resection. Nine months to a year is the usual interval allowed now.

the use of a brace was continued until 20 months after the fracture. Motion of the knee was good although slightly limited. Three years after the fracture the patient is walking with a cane, with ¾ inch shortening and shows no signs of infection. The femur is regenerated firmly although somewhat broader and flatter than the original bone and the use of the cane is continued for greater security (Figs. 9 and 10).

CASE 9. C. F., a white male, entered the hospital at the age of 16 years having had incision and drainage operations upon the ulna and upper end of the right femur within the preceding year. He presented on admission, two sinuses over the lateral portion of the right upper thigh, three over the outer end of the left clavicle, and a healed scar over the lower end of the right ulna. The head and neck of the femur were thoroughly curetted and 9 months later the patient was walking without the aid of a cane, there being firm ankylosis of the hip with discharge from a small sinus. However, the clavicle was still discharging and this bone was resected. A year after the operation on the femur, the process in the ulna reawakened, and the ulna was resected leaving a half inch below and an inch above. Healing and regeneration proceeded rapidly and two years later,

Fig. 11. Case 9. Two months after resection.

in November, 1924, there were no discharging sinuses, the bones were all firm, there was but 1 inch shortening of the right leg, and perfect function of right elbow and wrist (Fig. 11).

CASE 10. J. P., a white female entered the hospital in May, 1922, at the age of 16 years. In the fall of 1920 an abscess of the hip was opened and discharged for several months until the knee of the same leg became swollen, the latter condition improving considerably under the influence of baking. On admission the X-ray showed some roughening of the bone with periosteal thickening and there were signs of abscess in the lower outer portion of the thigh. There was a definite abscess cavity about the bone, with a shell-like portion of bone lying free but there were no sinuses leading into the bone. The wound almost healed and then broke down again, following which resection of about 7 inches of the lower end of the femur was performed. Convalescence was stormy, the knee joint became infected, but was cured by repeated aspiration of the purulent material. A month later, a large abscess developed on the medial aspect of the thigh. After about a year, firm union had occurred and the patient was walking with good motion of the knee but with 2½ inches shortening. Eighteen months after the resection, an abscess developed on the medial aspect of the thigh, and when it was opened a small piece of bone was found. The wound promptly healed and the patient is at present entirely healed, with good motion of

the knee. There is 3 inches shortening of the extremity partly due to deficient traction. This is the maximum shortening that has occurred.

CASE 11. E. P., a white girl, at the age of 12 developed an ulceration of the leg at the junction of the upper and middle thirds. The Wassermann was positive and the ulcer responded to antiluetic therapy, remaining healed for 1 year. The ulcer again recurred, exposing the bone this time, and both bones of the leg were fractured by a fall, with healing of the fibula but only fibrous union of the tibia. In the fall of 1922, the condition had become so bad that the necrotic shaft and the lower epiphysis were simply lifted from the leg, being surrounded by a large amount of foul pus. Excellent healing of the wound occurred with regeneration of the upper half but not of the distal half.

It should be stated that there was nothing to do but remove the epiphysis in this case, for the entire bone was one necrotic mass. The case is considered to be luetic osteomyelitis. What effect the removal of the epiphysis may have had upon the failure to regenerate completely is a question. Suffice it that the process has been entirely cured and complete function may be secured by a small bone graft.

CASE 12. L. F., a white female of 7 years complained of pain over the right tibia. The bone was bowed anteriorly and presented much thickening but there was no discharge and no fever. A diagnosis of non-suppurating sclerosing osteomyelitis as described by Garre (5) was made. The tuberculin and Wassermann tests were negative, and the patient was given antiluetic treatment as a therapeutic test, without results. Resection of the entire diaphysis was performed in October, 1922. No pus or cavity was found but the bone was very markedly eburnated and the medullary cavity almost obliterated. In December, 1924, her doctor reported an entire cure with healing, regeneration, and good function.

We would not recommend this treatment for this disease usually, for it is found that they are greatly improved by multiple trephining of the cortex, but the result in this one case was excellent. Jones (6) gives a review of the literature and describes a case, and Bloodgood (2) reports several cases encountered in a relatively short period, indicating that it is probably more common than often supposed.

CASE 13. J. H., a white male of 7 years, entered the hospital first in 1921. The diagnosis was cervical Pott's disease and the patient was placed on a Bradford frame for a year. In November, 1922, swelling and pain developed over the head of the left fibula which was resected. He entered the hospital 18 months later with an abscess of the neck. The fibula at this time was completely regenerated although somewhat deformed. Culture of the abscess revealed staphylococcus albus and the patient was treated with autogenous vaccine. The case is considered to be an infectious osteomyelitis and not Pott's disease as originally diagnosed.

CASE 14. A. M., a white male, age 40 years, was admitted to the psychiatric service, Cleveland City Hospital, July 5, 1923, with manic-depressive psychosis, of suicidal nature. The patient was very depressed, and had chronic osteomyelitis of the shaft of the left femur of 9 years' duration. Operation in another hospital 3 months previously. Blood and spinal fluid Wassermann negative. Operation, Cleveland City Hospital, January 4, 1924: Subperiosteal resection of 7 or 8 inches lower end of shaft of left femur above condyles. July 10, 1923, a pre-operative X-ray of the lower third of the left femur showed roughening, thickening, and a large area of destruction. March 16, 1924 and February 15, 1925, X-rays showed some areas of calcification in the periosteum. March 2, 1925, there was moderate bone regeneration but no union with condyles. March 12, 1925, the patient's condition was poor. He was melancholic and often refused food. Drainage had practically ceased. The patient would not permit a cast, splint, or other means of support to be applied. We could not secure a permit for amputation. Summary: The temperature was normal or sub-normal except for elevation to around 38 degrees C. for 2 weeks following resection. The ends have been allowed to come together by removing traction. Union may yet occur or might follow a short bone graft.

CASE 15. E. H., a white female, entered the hospital in May, 1924. She first became ill at the age of 3 and has had a chronically discharging sinus at the lower end of the femur ever since. She has had 9 operations upon the left femur, the last, 4 months before entrance to the hospital. A resection of 3⅛ inches of the lower end of the femur was performed, followed by an unusually mild reaction. The patient was referred home under the care of the family physician. In April, 1925, there was no sinus. The X-ray showed complete regeneration, the alignment was very good, and there was less than ½ inch shortening (Fig. 12). The patient is walking a little without support.

CASE 16. M. B., a colored female, age 11 years, entered the hospital in August, 1924. A year previously she had developed a painful swelling over the left tibia which was incised by a doctor. Since that time she has had no pain, but has had a discharging sinus.

Examination shows two sinuses over the left tibia just below the knee. The tibia is thickened and roughened, and somewhat larger than the right. The X-ray shows osteomyelitis of the upper half of the tibia. On August 27, a portion of the shaft of the bone extending 4¾ inches from the tibial spine was resected. There was one cavity, lined with soggy

granulations, which led up directly toward the epiphysis. This was curetted leaving an opening 1 inch deep and 5/8 inch in diameter. Two rubber tubes were then inserted, meeting in the center, one coming out at each end through the periosteum. The periosteum was carefully sutured together over these tubes. The leg was placed in a Thomas splint and after 6 hours, the wound was irrigated hourly with Dakin's solution through the tubes. There was a rather marked febrile and cardiac reaction but this subsided in 6 days. A series of X-rays (Figs. 13, a; 13, b; 13, c), showed rapid bone formation. Dakin's irrigations were continued for 1 month, and then saline was substituted since the discharge had become less purulent and much less profuse. The tubes were loosened after about 2 weeks, and were entirely removed at 5 weeks. Irrigation was then carried on with a syringe, the periosteum being patent from one opening to the other. Not quite 2 months after the operation the patient complained for the first time of pain in the left humerus. She had no elevation of temperature. Examination showed very definite thickening of the mid-portion of the bone. This had not been noticed before the operation, although no X-rays had been taken of the arms. The X-ray now showed "marked periosteitis with destruction area in the medullary substance of the bone. There is also slight eburnation." It was the opinion that this process antedated the resection of the tibia. Saucerization of this lesion was immediately performed with very little reaction. Both wounds healed very well although some small sequestra were extruded from the tibial wound. Six months later the discharge has ceased and while weight bearing has not been allowed, the bone is very solid.

a. *b.*

Fig. 12. Case 15. *a*, *b*, Two and one-half months after resection of 3 inches of shaft of femur. Showing complete regeneration 11 months after resection. Patient has now less than ½ inch shortening.

SUMMARY OF CASE REPORTS

The case reports include the resection of 21 long bones in 16 patients. Five patients had 2 resections each. There were 9 femora, all but 1 of which (Case 14) have regenerated completely and firmly, 2 showing the maximum shortening of about 3 inches (Cases 1 and 9). The 1 case in which regeneration did not occur was in an adult male of 40 years, in whom the age is undoubtedly the causative factor of the failure. However, after about a year, union is becoming much firmer and it seems as though he may still get a good functional result except for shortening.

There were 6 tibiæ: 2 (Cases 4 and 10) have only partly regenerated, one possibly because the femur was resected at about the same time, and 1 because the lower epiphysis was sacrificed (Case 10, luetic). One fractured at the end of 2 years with poor union, but has become firm under the influence of immobilization (Case 6). Three have regenerated solidly, although one has not yet been subjected to weight bearing.

There were 2 ulnæ, 1 of which failed to regenerate, possibly because the femur was resected at about the same time (Case 3). Of the 2 clavicles, both have regenerated completely, as has the 1 fibula and 1 humerus.

In the first 13 of the cases, or in other words, the first 18 resections, 2 years or more have transpired since the operations, and the results have more finality than the last 3, although osteomyelitis is a disease about which final results must be given cautiously. In every case but one (Case 14, the adult) there has been a decided improvement in the general health. We have personally examined within the past few months almost all of the cases reported, and to the best of our knowledge there is only 1 discharging sinus (Case 14) in the series of 21 resections. Of the 21 resections there has been incomplete regeneration in 4 (19 per cent); fractures in 4 (19 per cent); recurrence of infection in 2 (10 per cent), of which 1 was merely an abscess about a small detached piece of bone, healing occurring promptly without shaft involvement; and the other was the appearance of infection in a bone other than the 2 which had been resected, probably having as the source, a bone which

a. *a.* *b.* *b.* *b.* *c.*

Fig. 13. Case 16. *a*, Showing involvement of the bone before operation. *b*, Two and one-half months after resection of 4¾ inches of the shaft. *c*, Eight months after resection.

had merely been saucerized (Case 3). A second operation upon the bone resected has not been necessary in any of these cases.

There are 7 other cases which we are not including in the report, which have been done very recently, and are still in supports. There are 4 femora which are regenerating well, and 3 tibiæ, 2 of which are failing to regenerate.

DISCUSSION

As with any procedure, it is best to employ some selection of cases to which the remedy is to be applied. Nichols (7) and Clopton (4) have stated that the tibia is a favorable bone for resection because of the adjacent fibula which acts as a splint. Both of these authors had trouble with the tibia, although the latter author feels that bone grafting can be effectively resorted to and makes the resection operation quite successful in the event of failure to regenerate. However, our experience and that of Beye (1), who reports great misfortune in a group of 5 cases, the four tibiæ failing to regenerate, and the 1 femur developing a shortening of 3 inches, makes us hesitate to recommend resection of the tibia except in cases of necessity, when anything less radical will not remove infected bone. In these, if regeneration is incomplete, a bone graft may be inserted with good prospects of a useful leg. In many cases of osteomyelitis of the tibia, one or both ends are involved with a section in the middle which appears more or less normal in the X-rays. It is possible that this central section could be saved making necessary the filling in only of the short section at either end. This was tried in a recent case not included in this report and is offered merely as a suggestion. The femur, on the other hand, has great powers of regeneration and if persistent and sufficient traction is applied the shortening need not be great. It is interesting that Simmons (9) should state that resection of the femur is "impossible."

The reason for the failure of some of the bones to be replaced probably lies in the relatively deficient blood supply of the tibia and the bones of the forearm, and the constant regeneration of the femur is probably explained by its rich blood supply. We have made no study of the calcium metabolism of our cases and it is possible that such a study might throw some light on the failure to produce new bone. Age apparently has no

great effect, as the incidence of failure seems to be scattered equally in the various age groups. One would expect poorer bone replacement in adults, however.

With a somewhat more judicious selection of cases and some improvements in technique, we believe that failure to completely regenerate should not occur in more than 10 per cent of all cases of resection. A cure of the infection should occur in practically every case after one operation. In cases of multiple chronic osteomyelitis some of the foci, which one might term "secondary," appear to be well localized. It is not necessary to resect the shaft to cure such a focus.

In the matter of technique of operation, the periosteum should be closed as completely as possible over a drainage tube of medium size.

It is probable that most of the bone formation is by the periosteum which may then deposit layer upon layer about the canal left by the drainage tube, the canal being left as a medullary cavity or filling in from the ends by callus formation, to be subsequently restored to form a medullary cavity. The amount of the regenerated shaft formed by the endosteum is a matter of argument. It would seem to us that its rôle is slight.

Nichols' idea of sterilizing the cavity with carbolic and alcohol may be suitable in such cases as he reports, in which the resection is done about 10 weeks after the acute process subsides and in which the periosteum is lined with a flexible shell of bone. However, to use such drastic antisepsis in the chronic cases would be to destroy the periosteal cells upon which success so much depends. Dakin's solution may be used until the discharge becomes glary, and then replaced by salt solution while the tubes are gradually being withdrawn.

CONCLUSION

In properly selected cases of chronic osteomyelitis subperiosteal resection of the diaphysis of long bones, coupled with subsequent bone graft if necessary, offers a better chance of cure and normal function than the less radical procedures.

REFERENCES

1. Beye, H. L. Surg., Gynec. & Obst., 1923, xxxvii, 732.
2. Bloodgood, J. C. J. Radiol., 1922, iii, 310.
3. Cheever, D. W. Med. & Surg. Rep. City Hosp. Boston, First Series, 1870, 362.
4. Clopton, M. B. Surg., Gynec. & Obst., 1915, xx, 6.
5. Garre, C. Beitr. z. klin. Chir., 1893, x, 241.
6. Jones, S. F. J. Am. M. Ass., 1921, lxxvii, 986.
7. Nichols, E. H. J. Am. M. Ass., 1904, xiii, 439.
8. Phemister, D. B. J. Am. M. Ass., 1915, lxv, 1994.
9. Simmons, C. C. Boston M. & S. J., 1917, clxxvi, 653. Surg., Gynec. & Obst., 1915, xx, 129.

A CONGENITAL CYSTIC TUMOR OF THE NEURENTERIC CANAL WITH SPECIAL REFERENCE TO ITS HISTOLOGY AND PATHOLOGICAL SIGNIFICANCE

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OF all the pathological conditions encountered between the rectum and sacrum, tumors are to me the most puzzling. I include in this class the intradural and extradural tumors situated between the conus medullaris and coccyx. The disturbing features are the number of tissues found in a single tumor, the histologically malignant tissue encountered, and the inability to predict accurately, in the absence of a well grounded explanation for the origin of the condition, what will happen when a given tumor is apparently removed. The case reported shows what may happen along the course of the neurenteric canal and the facts involved will serve as a basis of a conception of most of the pathological conditions found in this region.

Case report. Path. No. A-24:12. House No. 60400. Clinical history. The patient was a female infant 1 day old brought into the hospital December 27, 1923, to have a harelip and cleft palate repaired. Operation was attempted January 16, 1924. During the operation the child became very cyanotic and operation was discontinued. She died the following day at 1:43 p.m. of bronchopneumonia.

Necropsy findings. The body is well developed and well nourished. Weight is 2,801 grams. Skin is cyanosed. There is a cleft palate and double harelip, and a congenital coloboma of each eye with elongation of each pupil toward the nasal cavity. The lower portion of the right lung is consolidated. The right lung receives two primary bronchi. The heart shows both great arteries arising from the right heart, a patent ductus arteriosus, patent foramen ovale and imperfect interventricular septum. The aorta arises to the right of the pulmonary artery and is separated from it by a wedge shaped piece of muscle. The cæcum is directly beneath the liver and has a mesentery. The kidneys show ununited tubules forming what might be termed polycystic kidneys. There is a double vagina and uterus.

The lower lumbar vertebræ and the sacrum are removed *en masse*. This is done because in the pelvis a mass measuring 6 centimeters in diameter is attached to a defect in the anterior surface of the sacrum by a pedicle about twice the size of a lead pencil. The vertebræ are then split and the accompanying photograph illustrates the pathology better than any description can. The third sacral vertebra is gone and the congenital cystic tumor passes into the bony canal at this level and is attached firmly to the anterior surface of the cord. The tumor is cystic and many of the cysts contain mucus. The relative size and position of the cysts can be made out in the photograph.

Histological report. The tumor presents the only interesting histological finding. The pedicle shows dense glia fibrils and resting glia cells. In the glia tissue are a few cells that appear to be ganglion cells but they do not stain well and cannot be definitely identified. There is also a small canal lined by ependyma. A little nearer the sacrum, there are cells and arrangements of cells which at once suggest the tumors arising from this region diagnosed as ependymal gliomata. The cysts contain columnar epithelial lining and the surrounding more solid tissue shows stratified squamous epithelium. Most of these findings are shown in the accompanying photomicrographs. In addition, the tissue contains a collection of lymphoid cells, fat, a few small islands of cartilage, some smooth muscle, myxomatous appearing fibrous tissue, nerves, and quite large blood vessels. The phosphotungstic acid hæmatoxylin stain shows that the cells having the arrangement of the so-called ependymal glioma tumors produce abundant glia fibrils. At the point of junction with the cord the structure resembles closely that of a gliosed spinal cord except that the horns are not formed. The position of the blood vessels, the glia in parallel arrangement, the so-called replacement gliosis, together with the shape and size of the pedicle and even the small canal lined by ependyma, are all reminiscent of a spinal cord.

At the beginning of the third month of embryonic life the neural tube extends the full length of the neural canal and is in close relationship with the deep layers of the skin. The bony canal grows rapidly; the cord fixed above is drawn away from the coccyx; the atrophied caudal extremity forms the filum terminale. The skin connection is evidenced by the caudal ligament and in certain cases by a postanal dimple or sinus. During early embryonic life there is a communication around the caudal extremity of the notocord between the central canal of the cord and the alimentary canal. The proctodæum or primitive anus invaginates and joins the cloacal

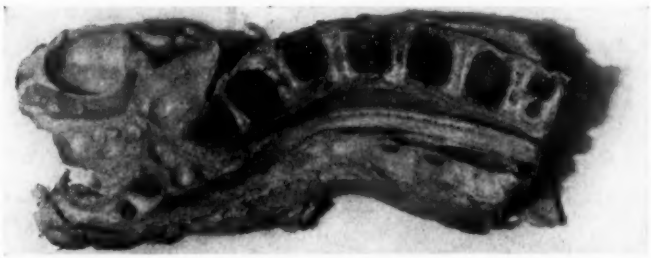


Fig. 1. Gross specimen. Shows tumor anterior to sacrum, pedicle replacing the third sacral vertebra and firm attachment to the anterior aspect of the spinal cord.

chamber anterior and above the enteric opening of the neurenteric canal. This leaves a portion of gut wall back of the anus which is known as the postanal gut. Most of these vestiges atrophy but it is logical to believe that they may persist in part or entirely and at any time during life give rise to definite pathological problems.

Mallory (6) reviewed the embryology with reference to the closure of the neural tube. He studied 7 human embryos for vestiges of this event and reported clinical cases with pathological conditions in this region which he thought were best explained on this embryological basis. He found a residue of tissue that contained epithelial and neural elements in 6 of the 7 embryos examined. The pathological tissue removed from the clinical cases showed cells of neural origin and neuroglia fibrils. He said nothing of the neurenteric canal or possible pathological conditions associated with the filum terminale. Middledorpf (7), in a report of pathology found in this region, reviewed the embryology in search of an explanation for tumors between the rectum and sacrum. He concluded that they were best explained as arising from remnants of the postanal gut. He did not mention the possibility that tumors found within the vertebral canal, in the region of the cauda equina, had a similar etiology. Borst (1) discussed the other theories postulated to explain the varied and complex pathology found here. They are all abstract, hard to comprehend and difficult

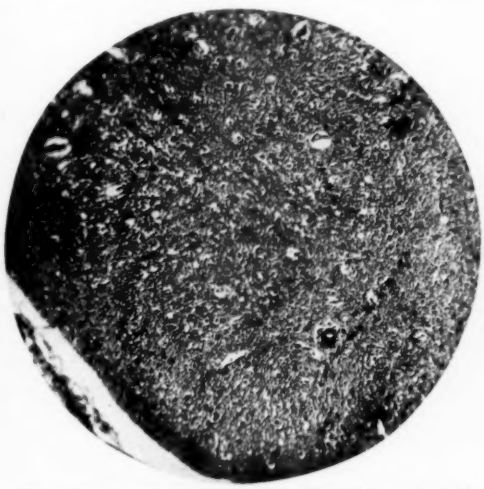


Fig. 2. Low power of pedicle. Showing tendency toward cord reduplication.

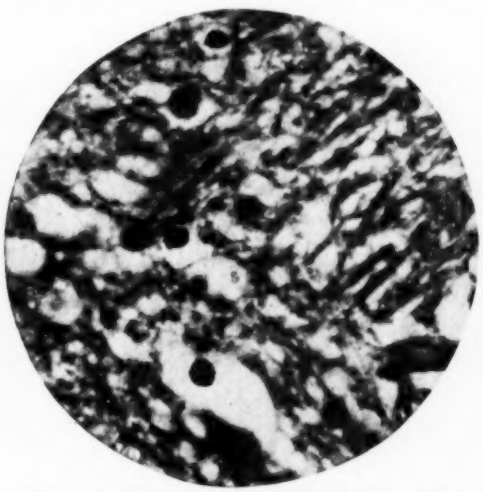


Fig. 3. Oil immersion (×800). Showing glia cells and glia fibrils.

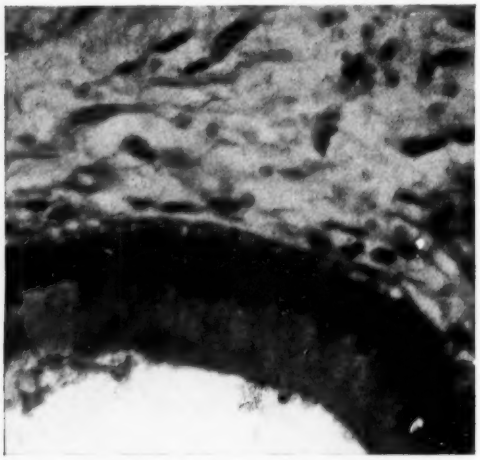


Fig. 4. High dry (×200). Showing cyst lined by high columnar epithelium.

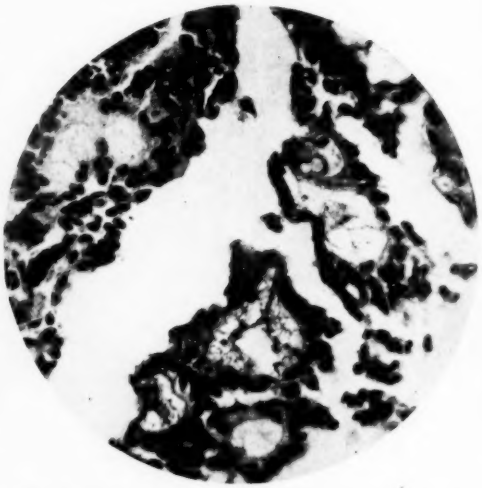


Fig. 5. High dry (×200) of tissue resembling the arrangement of ependymal glioma tumors of this region.

to remember. Keen and Coplin (5) reported a case in a child aged 2 who had a fistula passing through the sacrum and connecting the rectum with the skin over a congenital tumor on the posterior aspect of the sacrum. The anatomy of the tract was not worked out but we are inclined to assume that both the neurenteric canal and distal portion of the neural tube remained patent and that the opening over the sacrum corresponded to the opening of a sinus in some of the embryos studied by Mallory. Accordingly, the origin of tumors over the sacrum has been well explained; the origin of those arising between the rectum and sacrum has been suggested; but no attempt has been made to explain the peculiar tumors found in the spinal canal between the conus medullaris and the coccyx.

Fig. 6. Low power (×80) of cyst lined by stratified squamous epithelium. Cyst is filled with detached flattened epithelial cells.

It is important to compare the condition found to the histology of tissue from the canal and to determine whether or not this pathology is located in the course of the canal. The cases from three (2, 3, 8) important papers are brought together in a table to show the relationship of intradural and extradural tumors situated between the conus and coccyx and this congenital structure.

The tumors tabulated all lay in the course of the canal and in 1 case perforated the sacrum anteriorly and in another connected with a cyst in the pelvis through an anterior defect in the sacrum. The tumors compiled in the table are histologically similar to our case. It is recognized that tissue in the filum terminale might give rise to similar growths and therefore the tumors arising from congenital remnants in this region do not necessarily originate in the neurenteric canal.

Age	Sex	Symptoms	Location	Intra-dural	Extra-dural	Attached to cord	Defect	Diagnosis
29	F.	2½ yrs.	11D-4L	+		?	?	Glioma
16	M.	1 yr.	12D-3L		+	No.	?	Carcinoma
42	M.	5 mos.	2-5S		+	No.	?	Glioma
32	M.	8 yrs.	1L-5L	+		Conus	?	Glioma
28	F.	2½ yrs.	11D-5L	+		Conus	?	Ependymal glioma
25	F.	2½ yrs.	3L to 1S	+		No.	Yes	Ependymal glioma
27	M.	5 yrs.	11D-1S	+		?	?	Ependymal glioma
42	M.	8 yrs.	1L-4th L	+		Conus	?	Endothelial sarcoma
25	F.	2½ yrs.	1S-4L	+		Conus	?	Endothelial sarcoma
30	M.	?	1L-1S	+		Conus	?	Endothelial sarcoma
47	M.	3 yrs.	2L	+		?	?	Adamantinoma
10	F.	2 yrs.	Cauda	+		?	Yes	Ependymal glioma
38	F.	20 yrs.	Cauda	+		?	?	Neurofibroma
42	M.	6 yrs.	Cauda	+		?	?	Sarcoma
?	?	5 yrs.	Cauda	+		?	?	Ependymal glioma

Each case reviewed, however, indicates that the tumor arose from the neurenteric canal. Hundling's (4) review of tumors between the rectum and sacrum is quite complete. He inclines toward the embryological explanation. The names applied to these tumors are confusing. Most of them are designated as teratomata but the names found for the remaining tumors form a lengthy list. Every tumor found, even those spoken of by composite names such as chondromyxolymphadenosarcoma, might well have had their origin in a tissue residue of the neurenteric canal. Hundling noted that these tumors tended to invade the sacrum indicating that the growth infiltrated along the course of this structure. These facts indicate that the neurenteric canal is responsible for many abnormalities found along its course.

The behavior of these tumors is interesting. They remain quiescent for years and then frequently start to grow with rapidity. They may be encapsulated or invasive. Although they have histological appearances that permit of almost any diagnosis depending on rapidity of growth and type of tissue proliferation, these tumors have not been known to metastasize. This recalls other tumors attributed to fetal residues as adamantinomata, odontomata, Rathke pouch tumors, etc.

The tumors in the pelvis can be determined by rectal and proctoscopic examinations. An anterior defect in the sacrum, if present, is demonstrable. Tumors of the cauda equina are harder to diagnose. Often patients go from physician to physician with no other trouble but pain in the lower extremities. Such a case unless explored may remain undiagnosed for 25 years. When rapid growth begins, signs and symptoms are progressive according to the rapidity of growth. Surgery has given the best results. Many times the extent of the tumor cannot be made out before operation. It is at times impossible to remove the tumor intact. If this cannot be done, the benign nature of the tumor permits piece-meal removal without the fear of soiling. These procedures have been followed by X-ray and radium with very indefinite results from this part of the treatment.

BIBLIOGRAPHY

1. Borst, M. Centralbl. f. allg. Path. u. path. Anat., 1898, ix, 449–501.
2. Collins, J. L., and Elsberg, C. A. Am. J. Med. Sc., 1914, cxlvii, 493.
3. Cushing, H., and Ayer, J. B. Xandthochromia. Arch. Neurol. & Psychiat., 1923, x, 167.
4. Hundling, H. W. Ventral tumors of the sacrum. Surg., Gynec. & Obst., 1924, 813.
5. Keen, W. W., and Coplin, W. M. L. Sacrococcygeal tumor. Surg., Gynec. & Obst., 1906, iii, 661.
6. Mallory, F. B. Sacrococcygeal dimples, sinuses, and cysts. Am. J. M. Sc., 1892, ciii, 263.
7. Middledorpf, K. Zur Kenntniss der angeboren Sacralgeschwuelste. Arch. f. path. Anat., 1885, ci,37.
8. Parker, H. L. Tumors of the cauda equina, conus and epiconus medullaris. Am. J. M. Sc., 1922, clxiii, 342.

DEPARTMENT OF TECHNIQUE

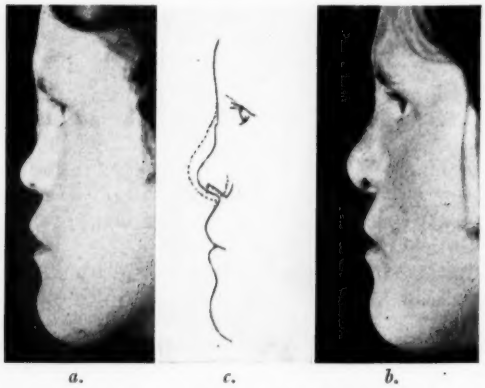
THE PROBLEM OF BRINGING FORWARD THE RETRACTED UPPER LIP AND NOSE[1]

By V. P. BLAIR, M.D., F.A.C.S., St. Louis, Missouri

RETRACTION of that part of the maxillæ which forms the foundation of the cartilaginous nose and related part of the upper lip, may cause changes in the human face that may vary from not pleasing to hideous deformity. The abnormality is more evident when viewed in profile.

The cases observed by the writer have fallen into the following etiological groups:

A. Those of apparently natural occurrence.

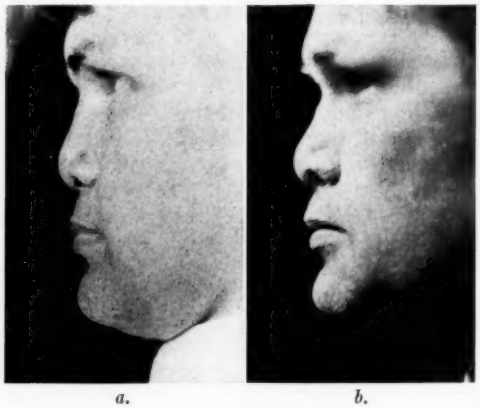


a. *c.* *b.*

Fig. 1, *a*. A young girl who originally had a saddle nose in conjunction with a moderate amount of flattening of the maxillary bone in the neighborhood of the anterior nares and proportionate anteroposterior shortening of the septum. She had been previously treated by the implantations of cartilage into the upper part of the dorsum, which accounts for the prominence of the bridge.

Fig. 1, *b*. The result of the implantation of a triangular shaped piece of the right eighth costal cartilage through an incision within the nostril after removing one of the original transplants. At a later operation another strip of cartilage was implanted upon this triangular piece to raise the tip further. By these operations the dorsum, the alæ and tip of the nose, the cheeks and upper lip have been brought forward. The amount of this forward movement is more easily seen in Figure 1, c.

Fig. 1, *c*. Superimposed tracings made from profile negatives, taken when the girl first came to us and after the completion of our second operation. This is a somewhat simple but usually not the most satisfactory plan of treating such cases. If there is much strain the cartilage is apt to bend and we have had to remove it in 2 cases. Bone is more rigid, but if rib is used it may not give sufficient body. (See Fig. 2, *a*.)

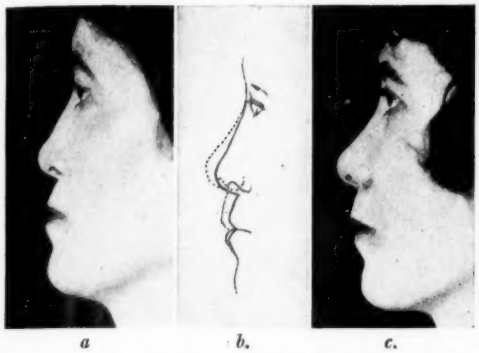


a. *b.*

Fig. 2, *a*. If, in a case similar to that presented under Figure 1, the attempted correction is made by the insertion of a straight piece of bone such as might be obtained from a rib, unless some plan is adopted to hold forward the lower end of the graft until bony union occurs, the tip of the nose will still lack prominence. This illustrates such a condition with a rib graft solidly united to the dorsal surface of the bony bridge.

Fig. 2, *b*. The result shown was obtained by lengthening the columella by means of a strip slid from the central part of the lip, and at the same time chiseling the nasal bones free from their attachments to the maxillary and frontal bones and the nasal septum. The nose was then pried forward and held in a more desirable position until union occurred. This was done by means of a metal bar, which had a dental anchorage below and passed up into the right nostril between the lip and the maxillary bone. This complicated and not overly satisfactory splint was ingeniously contrived by Dr. J. A. Brown, D.D.S., to meet the patient's objection to the long detention from his business that an external splint would have caused. The latter would have given greater final prominence to the tip of the nose. Figure 2, b, does not do full justice to the result because it is not a true profile.

[1]From the Surgical Department of the Washington University Medical School based on cases treated in association with Dr. Ellis Fischel, Dr. Earl Padgett, and the resident staffs of the Barnes Hospital, the St. Louis Children's Hospital, and the St. Louis Mullanphy Hospital. Presented before the Western Surgical Association, December 6, 1924, and the American Laryngological Association, May 6, 1925.



a *b.* *c.*

Fig. 3. If the retraction is limited to the lip and lower part of the nose it is not practicable to correct it by the implantation of either bone or cartilage unless one is willing to chisel away the prominence of the bridge before inserting the implant.

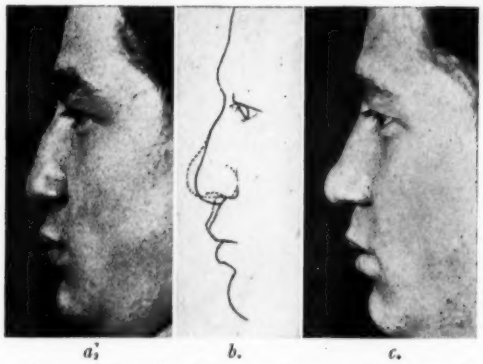
A young woman with a well developed nasal bridge in whom the retraction was limited to the tissues bordering the anterior nares. In this case, as in the immediately preceding one, the columella was very short, the anterior portion of each ala recurving backward to join it. The mesial crus of the lower lateral cartilage appeared to extend into the substance of the upper lip. In this type of case much improvement can be obtained by stepping forward the cheeks, upper lip, and lower part of the nose. This is done by freeing the lip and alæ with the adjacent parts of the cheeks, from the maxillæ, through an incision in the upper fornix which extends from one first molar tooth to its opposite fellow; this is continued up into the nose and forward along the lower border of the septum. The cheeks and lip can now be sutured in a forward position on the maxilla, which will correct the retraction about the anterior nares, and the columella can be stepped forward on the lower border of the septum which will give a forward tilt to the tip of the nose. The hæmorrhage following the freeing of these tissues is quite sharp and we have controlled it by gauze packing and, maybe, 10 minutes of finger pressure before attempting to suture. Just before suturing, a curved, semisharp elevator is passed between the skin of the dorsum and the cartilaginous bony framework of the nose. In one case of this kind, to give greater mobility, the writer made a circumferential division of the lining skin of the vestibule which was followed by a stricture. This subsequently required an intranasal skin graft for its relief.

Fig. 3, *a* and *c*. A case which was treated in the manner described under Figure 3. In this particular instance a vertical wedge of tissue was removed from the under surface of the middle part of the lip, which allowed the skin to fold forward to compensate for the shortness of the columella.

Fig. 3, *b*. Tracings made from the negatives of photographs *a* and *c* show how much was accomplished. A photograph sent by the patient 1 year later shows no appreciable recurrence of the retraction.

B. Those due to a loss of bony foundation of the lip, nose, or both, from trauma or disease.

C. Those in which the retraction has followed repair of a single or double congenital cleft of the lip and palate.



a *b.* *c.*

Fig. 4, *a*, *b*, and *c*. The same type as that shown in Figure 3 but more pronounced. The same type of operation was used in both cases.

Fig. 5. Superimposed tracings of a case similar to that shown in Figure 3. In this case two pieces each 3 centimeters long taken one from the 8th and one from the 9th right costal cartilage were inserted into a tract made just in front of the maxillary bone between the floor of the vestibule and the mucosa of the upper fornix; an external incision was made on each side in the ala labial fold which was immediately sutured.

This was not considered sufficient improvement and the operation described under Figure 3, *a* and *b*, was subsequently done in addition.

Among those of the first group the lack of maxillary prominence is most marked about the lower and lateral boundaries of the anterior nares and is accompanied by an anteroposterior shortening of the septum. The whole maxillæ may be contracted in size but in many instances the palate and alveolar process are absolutely normal in size and in their relations to the mandible.

Heredity or the atavism will no doubt account for many of the cases that would fall in the first group. In some the mucous lining of the nasal passages is markedly shortened from before backward which has suggested the thought that possibly early inflammations and scarring of this mucosa from infantile "snuffles" or other infections may have had a causative influence.

Besides direct trauma and ulceration the injudicious use of radium was the cause in 1 case included in Group B.

Following a repair of a congenital cleft of the lip and palate, there may be considerable retrac-

a. *b.* *c.*

Fig. 6. When the foundations as well as the upper lip and nose have been destroyed, much can be gained by transplanting the cheeks forward, after the plan described under Figure 4, before attempting to build the lip and nose.

Fig. 6, *a*. Profile of a man who had, a number of years previously, lost from an ulceration the whole nose, part of his cheeks and lip and the anterior half of the palate and alveolar processes of the maxillæ.

Fig. 6, *b*. The result obtained by freeing the cheeks and suturing them forward.

Fig. 6, *c*. Final result after the nose and lip were made from a bald scalp flap and a cartilage was implanted into the bridge.

tion which will vary with the type of repair employed. Usually it is most pronounced in the alveolar part permitting a backward displacement of the upper lip with or without some snubbing of the nose but in cases in which a "V" has been cut from the lower free border of the septum to move back the premaxilla, the nasal snubbing may be the most noticeable feature.

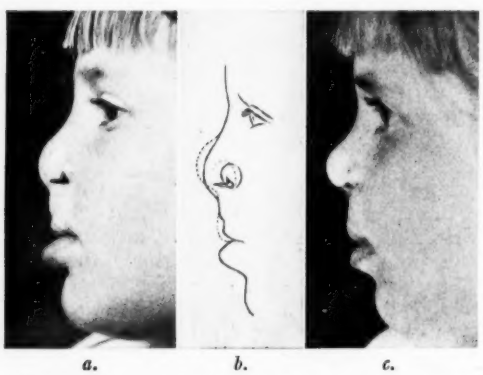
The common characteristic of these cases is a receding upper lip or the tip of the nose, or both, but the abnormal anatomy producing this retraction varies in different cases both in kind and degree, and must be considered in seeking the most appropriate plan of correction in each instance. In general there are two surgical plans applicable to the correction of this condition; one is to build out the deficient maxillary foundation, thus pushing forward the retracted soft tissues; the other is to draw them forward and fix them in this position. A combination of these two plans will often give the best results.

The retracted maxilla may be built out or supplemented in a number of ways.

Orthodontic treatment will give very great help in some cases when they are seen early.

We have used the following plans to build up the bone about the orifice of the anterior nares: the implantation of cartilage; the use of a dental prosthesis after the soft tissues have been liberated from the periosteum of the maxillary bone and the sulcus has been lined with Thiersch grafts; the cheeks have been liberated from the maxillæ and sutured in a forward position; and the lining of the nasal tube has been lengthened with a flap from the forehead, arm, or the mucosa of the mouth. The soft tissues have been drawn forward and suspended in this position, either by the implantation of cartilage or bone between the skin and framework of the dorsum of the nose, or by suturing the liberated columella in a forward position on the lower border of the septum.

There is a type of retracted nose in which the septum and the columella are both short, part of the cartilage of the latter being buried in the lip. The columella is also short in the complete double congenital cleft of lip and palate. In these cases the columella will have to be lengthened in order



a. *b.* *c.*

Fig. 7, *a*. A common deformity that may follow a harelip operation in which the premaxilla was moved back, is a lateral spreading of the nostrils, an extremely short columella, and snubbed nose.

Fig. 7, *b* and *c*. Shows such a case treated after the plan detailed under Figure 3, plus the excision of a diamond shaped piece of skin and subcutaneous tissue from the base of the columella and upper part of the lip.

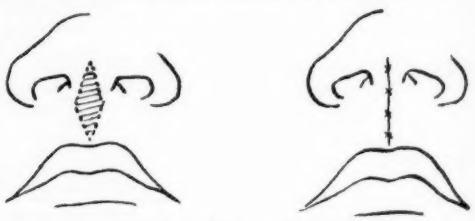


Fig. 7, *d*. The diamond shaped piece of skin and subcutaneous tissue was excised from the base of the columella and upper part of the lip. This latter step decreased the septolabial angle. The excessively long lip will be shortened at a subsequent operation.

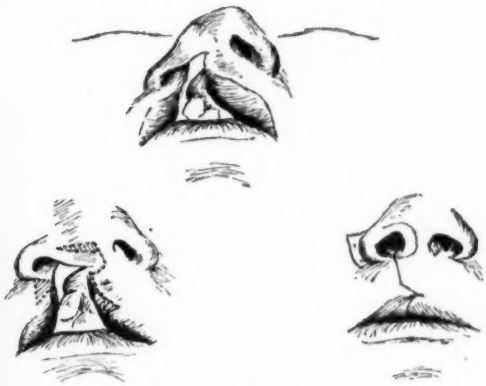
a. *b.*

e. *f.*

Fig. 8, *a*, *b*, *c*, *d*, *e*, *f*, and *g*. If a single harelip remains unoperated upon for some years or if the operation does not establish a proper relation between the base of the columella and the ala on the affected side, then with growth there will develop a characteristic variation which consists primarily of a unilateral retraction of the lip and nose and when pronounced can be satisfactorily relieved only by stepping forward the lip, cheek, and columella of the affected side. This necessitates the splitting of the columella in the midline and usually the removal of a "V" under the lip to allow one-half the columella to be stepped forward.

Fig. 8, *a* and *b*, show the front and side views of such a case before and after operation and Figure 8, *g*, shows the plan of the operation.

c. *d.*



g.

Fig. 9. If there is much retraction of the anterior part of the maxilla, the lip may have to be held forward, either by orthodontic treatment or by a prosthesis. This shows the result of a previous correction after the loss of the anterior one-half of the palate and alveolar processes of the maxillæ and part of the upper lip from trauma. The lip is adherent to the bone. The later treatment of the case consisted in first freeing the lip from the maxilla to well above the attachment of the alæ, and lining the new sulcus with Thiersch grafts. This required two operations. Later a full thickness triangular flap was turned from the lower into the upper lip at the site of the greatest loss.

Fig. 9, *b*. Shows the result of these operations before insertion of the prosthesis.

a. *b.* *c.*

Fig. 9, *c*. Shows patient's appearance when wearing an upper dental plate which is so planned as to compensate for the lost part of the maxillæ.

to bring the nose forward. In some cases the external nose was so small that it was necessary to piece out the covering as well as the lining in order to obtain a desirable result.

a. *c.* *b.*

Fig. 10, *a*. Shows a woman who had been operated upon in early childhood for a complete congenital cleft of the lip and palate. There is a loss of the premaxillary bone and the lip is very thin, much scarred and bound down to the maxillæ. The first step in the treatment was to liberate the lip, base of columella and alæ by incision and Thiersch graft as described in Figure 9. Next the whole outer surface of the lip was replaced with a flap from the forehead giving the result shown in Figure 10, *b*.

Fig. 10, *c*. Shows tracings for comparison. Note how much the alæ septolabial angle and the lip have been brought forward, but the tip of the nose has been moved very little. The case could still be improved very materially by transplanting the columella forward in the septum with corresponding forward movement of the tip. The new lip is still thick from recent operation.

a. *b.*

Fig. 11, *a* and *b*. The retraction may be complicated by a very short mucous lining of the nasal fossa which will have to be lengthened before the tip of the nose can be brought forward. This was accomplished by piecing out the covering as well as the lining. After freeing the soft parts of the nose from the maxillæ and nasal bones through a crescent incision across the bridge which completely divided the septum and the lining mucosa, the nose was drawn forward and the gap in the lining was pieced out by means of a forehead flap let in through the external incision. After this tissue had healed in place, the pedicle was cut and part of the remaining flap was used to lengthen the external surface of the nose.

Fig. 12, *a*. In this case the soft parts were freed from the bones through an incision in the upper labial fornix and the cut mucous lining was pieced out by means of a flap from the arm let in through an incision in the upper fornix.

a. *b.* *c.*

Fig. 12, *b*. The final result obtained by this operation and the subsequent implantation of a rib cartilage into the dorsum.

Fig. 12, *c*. The condition immediately after the first operation was completed and the pedicle of the flap returned to the arm.

FRACTURES OF THE OS CALCIS[1]

By L. IRVING CONDIT, M.D., F.A.C.S., Detroit, Michigan

THIS is a short review of 15 cases observed during a period of 24 months, from January, 1922, to January, 1924, with the object of determining a definite period of disability.

Fractures of the os calcis are an unusual injury in a general practice. They are unusual in any form of employment except the building trades, but comprise about 1 per cent of all fractures in this line of work.

These fractures are almost invariably caused by a fall or by landing on the feet. When there are no other fractures they are usually confined to falls of not over 10 feet. If the fall is greater, they are complicated by fractures of the long bones above, and severe injuries to the ankle joint itself.

The *forms of fracture* are varied. They may be, and rather commonly are, comminuted. There are 7 cases of this series that had more than one fracture line, 5 cases with one line, and 3 compound cases, 1 of which was comminuted and 2 not. The axis of the posterior portion is lengthened laterally as a result of compression. The arch of the foot is disturbed and a flat foot results, causing severe disability, particularly to the carpenter or laborer in whom this fracture commonly occurs.

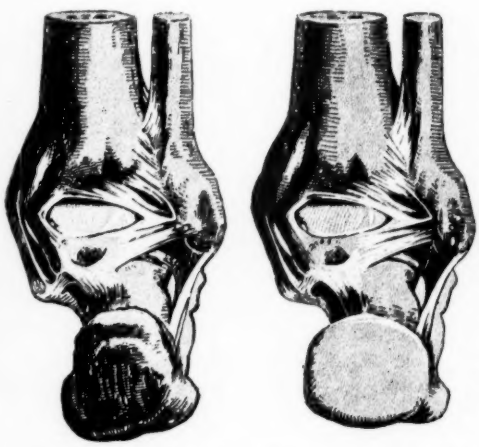


Fig. 1 (left). Normal outline of os calcis, posterior view.
Fig. 2. Same view as that in Figure 1, showing flattened aspect.

The *diagnosis* should of course be made by X-ray, but there are clinical signs that should always be looked for as follows:

First, there is swelling and thickening posterior to the mediotarsal joint on both the internal and external surfaces. Second, thickening occurs below the external malleolus. Third, there is no disturbance in flexion or extension of the ankle joint, but there is marked limitation of lateral motion, that is, pronation and supination. Fourth, in taking the X-ray picture it is very important to get a projection through the bone from above downward to show the amount of disturbance in the lateral diameter.

TREATMENT

Nine of these cases were treated by open operation. The open operation in 5 of the 9 was a tenotomy (complete) of the tendo achillis. A small incision was then made directly above the posterior portion of the os calcis on both sides. A heavy round instrument was passed through above the bone and this portion brought down. This was done quite easily after the tendo achillis had been severed. In these 5 cases there was an avulsion of the posterior portion of the bone, which had been pulled up by the tension of the tendo achillis.

The impaction which is almost invariable in all fractures of os calcis was then taken out by placing the posterior portion of the bone just under the malleolus over a sandbag and striking the other side with a heavy padded mallet. A roller bandage was placed on either side just under the malleoli as noted in the operation. This was done on both sides. In the other 4 cases, it was necessary to make a larger incision and replace the fragments. In 2 cases chromic catgut was used to hold the fragments. Of the 6 cases not operated on, 4 were treated by the sandbag and mallet method, in the last 2 nothing being done but the usual immobilization. In all 9 cases the dressing was a pad or roller bandage on the arch with the foot in hyperextension and a plaster cast. The time of having the cast on varied somewhat, but in the average case it was left on 3 weeks. It was then removed daily or every other day, and passive and active motion begun. The cast was removed entirely in 5 to 6 weeks.

[1]Read before the Detroit Academy of Surgery, May 22, 1925.

Fig. 3.

Fig. 4.

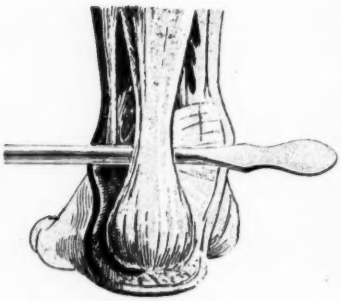


Fig. 5.

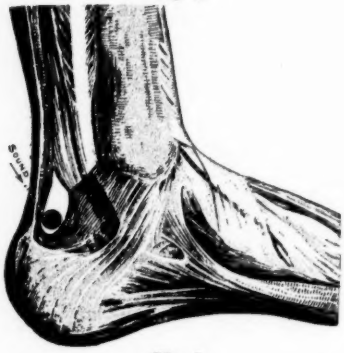


Fig. 6.

Fig. 3. Lateral view.

Fig. 4. Same view as that in Figure 3, showing flattened arch in type of fracture with complete avulsion of posterior fragment.

Fig. 5. Posterior view showing position of metal instrument used to pull down on after tenotomy.

Fig. 6. Lateral view showing position of sound anterior to tendo achillis.

Fig. 7. Schematic drawing showing position of roller bandages used to protect soft parts when the impaction of the os calcis is being taken out.

PROGNOSIS

There has always been considerable difference of opinion regarding the period of disability in fractures of the os calcis. We must consider the type of man and the work he does. The disability in these cases is not based on the statements of the patients but on the period covered by compensation and the actual date of return to work. This was secured from the compensation records.

Of the 9 cases operated on, the shortest period of disability was 7 weeks, the longest 19 weeks. Of the 6 cases not operated on, the shortest period was 12 months. One case was that of an old luetic negro, 65 years of age, with a congenital flat foot. The other was a case of bilateral fracture, one of which was severely comminuted and compound.

A NEW BLOOD TRANSFUSION APPARATUS

By DANIEL McLELLAN, M.D., C.M., B.A., Vancouver, B. C.

THE following is a description with illustration of an apparatus for the direct transfusion of blood, with the introduction of citrate and saline solution into the blood stream as it passes through the apparatus; and there are also a few points on its use.

An all-glass 30 cubic centimeter syringe is attached by means of a suitable adapter and rubber tubing to the stem of a Y-shaped glass tube. By means of rubber tubing the intake arm of the Y-tube is connected with the donor needle, the exit arm with the recipient needle.

On each side of, and a short distance from the Y-tube is placed a cone-shaped glass valve, the one on the donor side with the apex pointing toward the donor, the one on the recipient side with the base facing the recipient.

At a point midway between the donor needle, and the glass valve nearest the donor, a second Y-shaped glass tube is placed, to the stem of which a rubber tube 20 inches long is attached, the upper end connecting with a 300 cubic centimeter burette for citrate and saline solution. On this tube are placed a Murphy screw clamp by which the flow can be regulated down to a drop, and a cut-off clamp by which the flow can be completely cut off, as desired.

The needles are 15 gauge, preferably gold. A small particle of erosion in a needle is a focus for clot. Gold does not rust. The needles are attached direct to the rubber tubing. Every joint possible should be eliminated.

POSITION OF PATIENTS

This is important. Tables should be placed in the form of an L, or L reversed, or a T; the recipient's table forming the foot of the L or the cross of the T. With the donor's arm slightly outward but in a general way parallel to his side and the recipient's arm stretched out at right angles to his own body, the two arms are in the correct position for the insertion of the donor needle toward the finger tips and the recipient needle toward the heart.

A standard with a goose-neck attachment capable of being easily raised or lowered stands in the angle formed by the two tables and is out of the way of the small dressing table. From this goose-neck hangs the burette.

The proportion of sodium citrate solution to normal saline is a matter which can be decided by the operator. By using a mixture of 2 ounces of a 3 per cent solution of sodium citrate with 18 ounces of normal saline solution and allowing enough of this mixture to come through in drops, it will be found that even less than one-third the usual amount of citrate is necessary. In fact when smaller quantities of blood are being transferred, say 6 to 10 ounces as in children, once the first stroke of the syringe is made the citrate-saline solution may be cut off altogether.

EXPELLING AIR FROM THE APPARATUS

Clamp off the long tube. Fill the burette with warm citrate-saline solution. Screw down the Murphy clamp to allow a moderate flow. Immerse the needles in a bowl of citrate-saline solution. Release the cut-off. A few strokes of the syringe will expel the air. The last bubble may be expelled by inverting the syringe. The automatic action of the valves may here be observed. As

the piston is drawn up the valve in the intake arm opens allowing fluid (blood) to be drawn up into the syringe, and as the piston is pushed down the valve closes, preventing the passage of fluid backward through the needle. As the piston is pushed down the valve in the exit arm opens and fluid (blood) is allowed to pass through the valve into the vein of the recipient; and as the piston is drawn up the valve closes preventing blood being drawn back from the recipient.

REGULATING THE FLOW OF CITRATE-SALINE SOLUTION

Place a suitable clamp (dayspring pinchcock) on the rubber tube between the Y-tube (burette) and the valve nearest to it. Screw down the Murphy clamp tight. Release the cut-off clamp. Unscrew the Murphy clamp until the solution comes from the needle in drops about 100 to the minute. Close the cut-off clamp until you are ready. Take off the pinchcock and place it on the tube between the Y-tube (burette) and the donor needle. The clamp could be placed here at first but in regulating the flow you would need to see that the syringe piston is not forced out by pressure of fluid, so that you are given a wrong conception of the rate of flow.

TOURNIQUETS

Any suitable tourniquet may be used but I find that the old Army screw tourniquet with the block removed is excellent. You can release it in a second without disturbing the arm, and in the case of the donor it can be loosened or re-applied at will. I think it is a mistake to have your donor lying down too long before operation. Let him move around until the last minute and you will get a much better flow.

INSERTING THE NEEDLES

Insert the recipient needle first. Immediately loosen the tourniquet and release the cut-off clamp on the burette tube. The liquid begins to flow through the apparatus into the recipient slowly but fast enough to keep the fluid in motion and gives no chance whatever for the formation of clot.

This bridges over that bane of direct transfusions, that space of time, sometimes short but unfortunately sometimes longer, between the insertion of the recipient and donor needles. See that the syringe piston is kept pressed home at this stage, as it may be forced out by the solution.

Insert the donor needle. Remove the pinchcock and proceed by steady, easy strokes to pump the blood from the donor to the recipient. Count the strokes. By the simple deduction of the quantity of citrate saline solution from the total, you will get the actual quantity of blood transfused.

Time and experience will decide which size of syringe is best to use with this apparatus, whether a 30 cubic centimeter, a 20, or a 10.

EDITORIALS

SURGERY, GYNECOLOGY AND OBSTETRICS

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JANUARY, 1926

THE HARD LOT OF THE CANCER PATIENT

THE lot of the cancer patient, receiving the best possible treatment that can be offered, is unenviable. The lot of the cancer patient, who, by neglecting treatment, experiences the normal inevitably fatal and loathsome course of cancer, is hard enough. The lot of the cancer patient, who, nearing his end of torture, in sad retrospect, learns that his disease could have been cured by relatively simple measures, and that he has been deluded by false prophets and false theories until his case is hopeless and his family penniless, is indeed pathetic.

Our problem, as physicians, is to make easier the lot of the cancer patient. The promulgation by accredited physicians of half-baked theories and pseudo-scientific work adds to his difficulties.

The American Medical Association, the American College of Surgeons, and the American Society for the Control of Cancer, have done much to educate the public. This education forms a good psychological background, but the individual who has cancer demands action. To discuss theories with the cancer patient is to jest with him. The only question which seriously interests him is, "What can be done for me?" When a patient is told by a responsible physician that he has cancer, he is dazed, terror stricken, and feels hopeless. Any chance for escape is seized upon. The more positive the promise of cure, the more enticing is the prospect. With avidity, he reads in metropolitan magazines the announcement of an electrical instrument by which its possessor can from one drop of blood discover and locate cancer and with a similar device can effect its cure. A fitting climax is reached when, during a meeting of the American Medical Association, he observes a picture of the originator (a regularly licensed physician) occupying a full page of a great newspaper and bearing the significant caption, "Our Most Distinguished Citizen."

Other front page newspaper articles, quoting recognized medical authorities, announce a new development by which X-rays are made to converge in the deeper parts of the body and destroy a deep cancer without injury to intervening or adjacent tissues. The inference is that surgery is needless, radium out of date, deep X-ray the final word. Again to the utter confusion of the cancer patient, his morning paper states that a great newspaper "will announce tomorrow" the details of the discovery of the germ of cancer along with a serum for immunization and cure. A few days later he reads in many daily papers the announcement that the scientist himself has read a paper at a medical meeting at which lawyers, newspaper men, and others took part, and the address was of a character to inspire, in blazing headlines, such terms as, "Germs

of Cancer Isolated is Claimed," "Cancer Serum Seeming Cure," "New Era Opens to Science," "Description of Great Discovery Given," "Experiments for Inoculation and Immunization Are Declared Complete and Effective in Results." His complete overwhelming is achieved when deep down in the conglomerate mass of newspaper publicity he identifies in various parts of the country, exclusive cancer serum agencies manned by highly reputable physicians.

It has been the hope of the profession that a causative parasite of cancer might be discovered. Waves of enthusiasm have come and gone. Large sums of money have been expended in the effort. Many false alarms have been sounded. A great effort to isolate the parasite is now in progress. Several rival claims are in. Let us assume that the parasite has been discovered. How will it benefit the cancer patient? Immunizing vaccines and curative sera have been developed only in those self-limiting diseases in which an attack immunizes against future attacks. The germ of tuberculosis was discovered more than 40 years ago. Tuberculin was developed. Yet it neither immunizes nor cures. The spirochæte of syphilis was discovered more than 20 years ago. Yet no immunizing vaccine or curative serum has been found. Cancer is not self immunizing. Therefore, an immunizing or curative cancer serum must be the product of a new principle in science. The discovery of a cancer parasite might lead to avoidance of the source of infection. It is possible that a diagnostic test might result. There is little reason to hope for more. The discovery would probably not materially change treatment.

We can now offer the cancer patient much encouragement without resort to speculation. Broders' cytological classification, founded on MacCarty's study of the individual cancer cell, has done more to clarify the cancer question for rational treatment than any contribution in recent years. By studying a large number of squamous cell cancerous growths with the corresponding histories and follow-up records and dividing them into four classes to be used as an index of malignancy, he found that in Class 1, in which 25 per cent of the cells were embryonic and undifferentiated, 92 per cent of good results were obtained; in Class II, with 50 per cent of embryonic cells, 62 per cent of good results; in Class III, with 75 per cent of embryonic cells, 25 per cent of good results; in Class IV, with 100 per cent of embryonic cells, 10 per cent of good results were obtained. The Mayo Clinic, working on this basis, has shown why certain cancers should be treated with radiotherapy while others do best with surgery. Radiotherapy destroys undifferentiated embryonic cells much more easily than normal cells.

In the average case of cancer of the cervix, there is a large percentage of undifferentiated cells. Surrounding the cervix in close proximity are the ureters, bladder, and rectum. Cancer cells emanating from the cervix, at a very early stage, so distribute themselves near and around these organs, that surgery, which is both radical and safe, is impossible. Radium, by destroying the embryonic cells before it injures normal mature cells, takes precedence over surgery in these advanced cases of cancer of the cervix. Percy claims the same advantages for slow heat. In the more chronic forms of cancer so located that the growth and nearby lymphatics can be removed with ease, such as cancer of the breast and gastro-intestinal tract, including the rectum, surgery rightfully claims the field. For deep incurable malignancies and their lymphatic metastases, for growths of the sarcomatous or lymphosarcomatous types and as a postoperative prophylactic treatment, radiotherapy claims the field and acts through

irritation; producing dense, fibrous connective tissue which cuts off nutrition from the cancer cell and encapsulates it. In surface cancers of low malignancy, diathermy, possibly best exemplified by Wyeth's endotherm, is the agent of choice.

The pathologist, skilled by study and experience in immediate microscopic section diagnoses, becomes a keystone. From the microscopic section, he may prognosticate the future and also determine the best form of treatment in a given case. The surgeon with his knife makes possible the work of the pathologist and with his knife subsequently cures the great majority of curable cancers. Carpenters, plumbers, and masons are all required in the building of a great structure. The engineer has the perspective and apportions the work to the various technicians. The trained surgeon is the engineer in the treatment of cancer.

According to W. J. Mayo, when the cancer has not extended beyond the primary focus, more than 72 per cent of patients are cured. If cancer cells have left the primary focus, only 19 per cent are cured. As there seems little prospect of marked immediate improvement in the treatment of cancer, except by earlier diagnosis, our next great duty is to instruct the potential cancer patient in terms which he can understand so that he may more promptly seek relief. The following statement though incomplete, seems adequate for the layman:

"A cancer or malignant tumor is a growing mass of non-functioning cells capable of growth and reproduction in the same form after transplantation to a distant organ or part of the body. This movement takes place through lymphatic vessels in which are placed filters—lymphatic glands. Beyond these filters the lymphatic vessels empty their contents into the blood stream. A cancer cell originating from a growth in a given organ and having broken into a lymph vessel floats onward and is caught in a filter. Here it forms another cancer of the same type. Some of these cells break away, float on further and may be caught in still another filter. Finally, having passed the last filter, the cancer cell enters the blood stream which circulates in all parts of the body. At certain places, such as in bones, the lungs, kidneys, liver, etc., the blood passes through small vessels where the large cancer cell is lodged and begins its growth and the formation of a new cancer out of reach of any form of treatment. A cancer, before a single cell has left its original location is curable by any destructive means whatsoever, including the knife, cautery, caustic or what not. If one cell has left the original growth and has become lodged in a distant filter, removal of the original growth alone does not cure. The cell in the filter soon forms a new cancer. This has usually occurred when the cancer has been discovered but if the filters—lymphatic glands—containing the cancer cells are removed with the primary growth, the cancer is cured. If one cell has escaped through the last filter into the blood stream, the case is hopeless. Therefore, cancer becomes the greatest of emergencies for no one knows the day or the minute a cancer cell has reached or will reach the blood stream. It, therefore, naturally follows that the best treatment of cancer is accomplished by surgery based upon accurate anatomical knowledge and consists in the removal of the primary growth and also the lymphatic vessels and glands intervening between the growth and the entrance of the lymphatic vessels to the blood stream. When removal is not practical or is incomplete, radiotherapy is the only remaining remedy."

In these days of publicity and commercialism, it is well to be prepared to differen-

tiate the true and the spurious by remembering certain principles of ethics in science. He who reveals the cause and nature of cancer must be a true scientist. The scientist is a devotee of truth. He courts investigation and therefore submits his facts to his peers before submitting them to the public. When he publishes them he gives them to the scientific press before giving them to the lay press. In revealing great fundamental truths in medicine, there has been no notable exception to this rule.

The scientific physician is an altruist. His mission is to save life, prevent disease, restore health. He never withholds from other members of his profession any remedy or agency that may be of value in the treatment or prevention of disease. He never arrogates to himself an exclusive or secret remedy for purposes of personal gain. The scientific physician would rather be a Pasteur in poverty than an Abrams in affluence.

R. C. COFFEY.

ARTHROPLASTY

THE mobilization of ankylosed joints is one of the problems that confronts modern surgery. Here and there at odd times, the subject has been brought forward for discussion. The rarity of ankylosis as compared with other lesions that the surgeon is called on to relieve, the somewhat exacting technique, and the extremely important position that the long postoperative supervision assumes in the management of these cases, have all been factors in the inexperience with arthroplasty of many otherwise experienced surgeons. The advancement of the specialties to their present position of increased surgical responsibility has caused just this type of case to gravitate naturally into the hands of the orthopedic surgeon, and the reports now forthcoming as a result of this segregation make possible a true perspective, and place the proper value on arthroplasty. Large series of cases are reported wherein as high as 80 per cent of the results of arthroplasty are satisfactory. A symposium at the International Surgical Association in London, in 1923, crystallized, to a certain extent, our knowledge of the subject. The discussion brought out clearly that arthroplasty was considered by some of the members to include all operations which had as their object the establishment of motion in an ankylosed joint. Accordingly, excisions were mentioned on equal terms with arthroplasty. The Italian and American participators in the symposium, however, contended that arthroplasty was considerably more than an excision. Arthroplasty has gradually developed and become standardized, the technique being modified according to the anatomic structure and the physiologic function of the joints. Prominent in such development have been the late J. B. Murphy, Putti, Baer, Campbell, MacAusland, and others. In America arthroplasty is considered to be a refined excision, its object being not only to produce motion but to furnish stability, and the operation is definitely planned and executed with these two objects in view.

The arthroplastic operations performed in the Mayo Clinic were reviewed recently, and 103 of 142 patients were traced. The results of the operation were satisfactory in 81 per cent of cases; either excellent or good in 62 per cent, and excellent in 38 per cent. The operations on the jaw gave the best results, the elbow the next best, the knee next, and the hip the poorest. From the findings in this and other series, certain fundamental principles can be deduced.

The destructive arthritis following the infection or trauma of a joint must be thoroughly quiescent, and manifested by absence of

pain, tenderness, swelling and local heat. Tuberculous joints must not be interfered with for fear of a flare-up. From a purely technical viewpoint, means must be taken to prevent union of the newly made surfaces, and in all except the jaw, interposition of a piece of tissue, preferably autogenous, is necessary.

The technique varies with the type of joint to be reconstructed. In operating on the jaw, owing to the structures of its joint, mere excision gives excellent results. Excision is also satisfactory in the upper extremities, but is less compatible with good function in the lower extremities, where the problem of weight-bearing is concerned. This is the most probable explanation of the contention that excisions are comparable in their results to arthroplasty. The surfaces must be reconstructed by the removal of just enough bone to allow a range of motion that will be sufficient for the function of the joint and still maintain the maximal stability. Suitable postoperative splintage must be provided for both the upper and lower extremities, but for the latter, sufficient traction must be instituted to separate the new joint surfaces. Mobilization must be started as soon as the blood clot is organized. Active and passive motion must be gradually forced to the limit, and at the same time physiotherapy, consisting of light, heat, massage, and exercise must be consistently carried out.

All surgeons emphasize the great necessity of the careful selection of patients who are to be subjected to arthroplasty. It must be considered first whether a movable joint will be more useful to the patient than the stiff one he already has, taking into account his occupation and his economic state, and second, the stability of the patient's nervous system and ability to stand pain must be determined. The patient's coöperation is necessary in order to carry out the after-treatment, which takes considerable time and often results in soreness and pain. Nervous, excitable, unstable patients, especially if they are intolerant of pain, are not good subjects for the operation. It is very evident that children should not be subjected to the operation.

MELVIN S. HENDERSON.

MASTER SURGEONS OF AMERICA

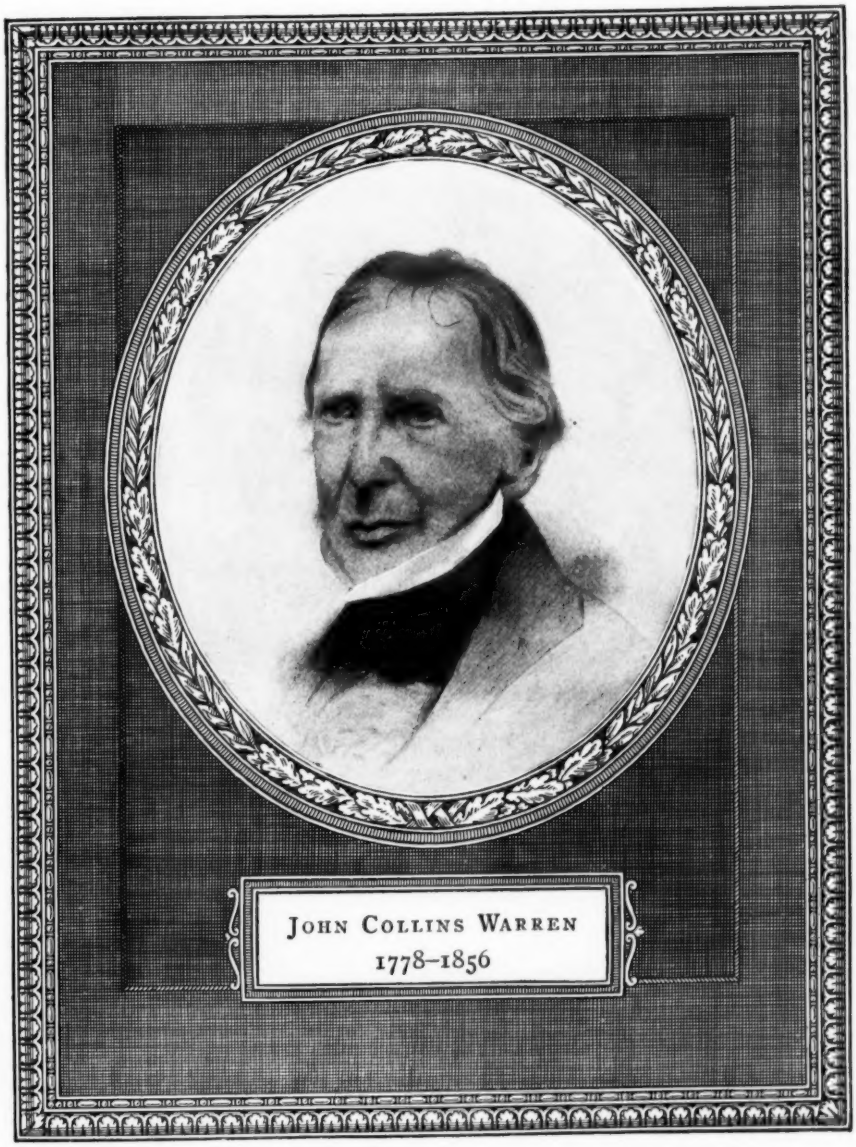
JOHN COLLINS WARREN

JOHN COLLINS WARREN was born in Boston on August 1, 1778. His grandfather, Joseph, was a prosperous farmer settled in Roxbury. His father, Dr. John Warren, was the younger brother of Dr. Joseph Warren, the Revolutionary patriot who was killed at Bunker Hill. John Warren was one of the founders of the Harvard Medical School. Warren's mother, Abigail, was the daughter of John Collins, Governor of Rhode Island from 1786 to 1789.

Warren received a good education in the Boston Latin School, graduating with honors and being the first to receive the Franklin Medal. Entering Harvard College in 1793, he graduated in 1797 with a class of 54, having a part in the commencement exercises.

He was not strong in body and not much given to worldly pleasures but strong in will-power and in resolution to make the most of his opportunities. His serious bent of mind seems to have been partly inherited and partly molded from his environment. His grandmother, a pious lady held in great esteem in her community, was still living. She had brought up a family, two of whom had been conspicuous examples of patriotism, his father John having also served in the Revolutionary Army as surgeon. Some of these qualities may also have been derived from Governor Collins, particularly those which enabled him in after life to rule with a stern hand.

At the time of his graduation, he had formed no decision as to the future; nor does he appear to have been biased by any parental influence. He was the eldest child of a family of seventeen and the economic situation was probably a trying one. A mercantile career seemed the obvious solution of the difficulty but the call of medicine must have been in the blood for, at the close of a year's time, he entered the Harvard Medical School. After a year of study in this institution, which was still in its infancy, he decided to complete his medical education in Europe. Accordingly he embarked for London in June, 1799, and on his arrival made an arrangement with Mr. William Cooper, surgeon at Guy's Hospital, to be his dresser for a year, for which he paid a fee of 50 guineas. As Mr. Cooper was the senior surgeon and made comparatively few hospital visits during the week, Warren had from the beginning almost complete control of his patients. Mr. Cooper was near the close of his professional life and before Warren left London



JOHN COLLINS WARREN
1778–1856

UNIV. OF MICH.

was succeeded by his nephew, Astley Cooper; and there was then formed between the pupil and his distinguished teacher a friendship that lasted throughout life. In London were great opportunities for study at the clinics of Cline in surgery, of Haighton in midwifery, of Abernethy at St. Bartholomew's; and at St. George's, under Sir Everard Home, he was enabled to get almost at first hand the teaching of the new science of surgical pathology, so recently inaugurated by Hunter.

A European medical education would have hardly been complete at this period without a visit to the Royal Infirmary in Edinburgh, where he passed the following academic year. The faculty of this school contained names still remembered as leaders in medical thought at that time, such as Munro in anatomy, John and Charles Bell in surgery, Hope in chemistry, and Gregory in medicine. Warren also became a member of the Royal Physical Society of Edinburgh, which brought the students and teachers into close contact for discussion and study.

In June, 1801, Warren left Edinburgh for Paris and passed the following winter in the household of Dubois, one of Napoleon's distinguished surgeons. This enabled him to meet many of the prominent teachers of that day. His clinical studies were conducted chiefly at La Charité. His chief pursuits were chemistry under Vauquelin and anatomy under Ribes, Chaussier, Roux, and Dupuytren. Bichat was one of the great lights of this period, which was a brilliant one in medicine. These with daily visits to the hospital occupied him somewhat more than 12 months. He notes that the French students with whom he was thrown were green from the Revolution and were for the most part a rude and vulgar set. Many hours were spent at the Jardin des Plantes, where he acquired a taste for natural history that became conspicuous in later years.

At the end of the following summer, he went to London and sailed for New York, arriving there in the autumn of 1802. He brought home with him the degree of M.D. from St. Andrews. On his return he was immediately plunged into a large practice, owing in part to the ill-health of his father, who had been for many years the leading practitioner of Boston. Warren records the fact that in the following summer, when he had entire charge of his father's work, he made some 50 visits a day. During the next winter, he acted as prosector to his father for anatomical lectures at Cambridge.

In 1803 he married Susan Powell Mason, daughter of Hon. Jonathan Mason, a prominent merchant of Boston; and in 1805 he occupied a house on Park Street, in which he resided for the remainder of his life. It was a roomy mansion, situated in the center of the residential quarter of a town which preserved strongly the earmarks of its English origin. The medical school was still in Cambridge and the apprentice system seems to have not yet been wholly abandoned. The Park Street house provided space not only for a class of medical students to foregather in a room with its sanded floor but for a certain period found room to accommodate a dispensary service.

In 1806 Warren was appointed adjunct professor of anatomy and surgery in Harvard University. He became prominent in the work of the Massachusetts Medical Society and, in collaboration with his life-long friend and colleague, Dr. James Jackson, he edited the *Pharmacopœia*, published by this society in 1808. Previous to 1811, no M.D. degree had been issued by Harvard but in 1819, Dr. Warren received the distinction of an honorary M.D. degree from this University.

Dr. James Jackson had been appointed professor of the theory and practice of medicine in the place of Dr. Benjamin Waterhouse; and Warren, at the time of the death of his father in 1815, became professor of anatomy and surgery. These two men set about to lay out a more comprehensive plan for medical education. Their appeal in a circular letter to the public in 1810 became a document of especial interest, for in it there was called attention, not only to the great benefits of a hospital to suffering humanity but to the important part which it played in the scheme for medical education. Their statement, "A hospital is an institution absolutely essential to a medical school," probably marks the first formal effort to elaborate an organization so characteristic of modern methods. A new medical school building was completed in 1815 and the Massachusetts General Hospital was opened for patients in 1821. The tie that bound these institutions was not as close as would be thought necessary at the present time but it served its purpose fairly well at that early period. At the opening of this hospital, Dr. Warren was appointed visiting surgeon and Dr. Jackson, visiting physician. These two constituted practically the hospital staff for many years.

On the death of Caspar Wistar in 1818, the professorship of anatomy in the University of Pennsylvania was offered to Dr. Warren; and it may be interesting to mention in this connection that later, on his return from Europe in 1838, he was offered the position of professor of anatomy and dean of the faculty in the University of New York. To both of these invitations he returned a decisive answer in the negative.

In 1812, the *New England Journal of Medicine and Surgery* was issued under the auspices of the medical school and this periodical was subsequently merged (1828) with the *Medical Intelligencer* to form the *Boston Medical and Surgical Journal*, a weekly publication in operation ever since. Dr. Warren became its first editor; and numerous articles on medical subjects flowed from his pen. A treatise on "Diseases of the Heart" and one on "Comparative Anatomy of the Nervous System" were among his early writings.

Dr. Warren brought back from Europe many novel ideas in the way of operative surgery, among which may be mentioned the operations for aneurism and strangulated hernia; the latter of which, he states, met with considerable opposition at first. He was one of the first to perform operations on the fissures of the hard and soft palates after the manner of Roux. His surgical practice became a commanding one, as had been that of his father before him. He notes later (1852)

that "the operations of lithotomy in Boston within the last sixty years have been performed by my father, myself, or my son" (Mason Warren). His position as editor fitted him well to record in writing a vast amount of surgical experience covering this long period. His most important publication was a book in 1837, "Surgical Observations on Tumors," which received a great deal of attention in this country and in Europe, and was translated into the German language. It is evident also that he had the intention of writing a book on "Clinical Surgery." The manuscript for this work, which had accumulated in great quantity but was never published, covers a most interesting period of surgical practice during the early part of the century. A few examples will suffice to illustrate this point. An operation for the removal of a loose cartilage from the knee joint is given in detail: the patient, after slight suppuration and some fever, attaining full convalescence and a satisfactory result. Several cases of dislocation of the hip joint are given and we find here, not only the old-time method of reduction by pulleys but a detailed statement of the method of reduction by taxis, such as was described by Bigelow and others a quarter of a century later. The reduction of a dislocation of a shoulder joint is effected by a method corresponding accurately to that now known as Kocher's Method.

After some 30 years of active work, Dr. Warren turned his practice over to his son and made a trip through Europe with his family. He renewed his acquaintance with Sir Astley Cooper and revisited the scenes of his study in Edinburgh, seeing there Sir Charles Bell. In Paris, he met Louis for the first time and obtained from Civiale the details of his new operation for lithotrity—which he was instrumental in introducing into this country on his return.

Mrs. Warren died in 1841 and two years later he married Anne Winthrop; after her death in 1851, he made another European visit, receiving great hospitality from political as well as professional friends. It was during this journey that he met Brodie and Clarke in London, and Velpeau in Paris. Although this trip was undertaken in search of health, the benefit proved only temporary and he was unable, on his return, to go back to full, active professional life but did devote much time and labor to scientific and literary work and was fully occupied in these pursuits almost to the date of his death.

Dr. Warren was elected a corresponding member of the Royal Academy in Paris, as well as of the Medical Society of Florence; an honorary member of the Medical and Chirurgical Society of London; and he also belonged to the American Philosophical Society of Philadelphia and to numerous other medical and scientific organizations both in this country and abroad.

In 1846 the medical school, which by this time had outgrown its building, was removed to a new site nearer the hospital. Dr. Warren took this opportunity to present his collection of anatomical specimens to the University, accompanied by a suitable endowment, and it has since been known as the Warren Museum of

Anatomy. He also left directions that, on his death, his body should be dissected and his skeleton prepared, articulated, and hung in the Museum, where it remains to this day. He had passed through the trying times which ultimately terminated in the passage of the Anatomy Act. Those who may feel inclined to criticize such a disposition of his body, have only to refer once more to the repulsive details of the trial of Burke and Hare[1] and the fate of some of those professors whom they served, to look upon Dr. Warren's judgment from a new point of view.

In 1849 the American Medical Association held its annual meeting in Boston and Dr. Warren was elected president and delivered the annual address at the gathering in Cincinnati the following year. A pen-picture of Dr. Warren by a contemporary gives an interesting description of the personality of the man: "His appearance was remarkable, and such as to attract the attention of everyone who came in contact with him. His almost painfully thin yet upright form; his high forehead covered with scanty gray hair; his shaggy eyebrows shading his bright piercing eyes; the deep lines in his strongly marked face—all showed the man of iron will and cool, fearless determination. Nor was this in any way disproved by the high, brusque, authoritative tones of his voice when lecturing or about to engage in some operation. Here the wonderful steadiness of his hand, the unyielding, unimpressionable character of his nervous system, when interested in any detail of his profession, showed one reason for his professional success."

Dr. Warren was a man of deep religious turn of thought and a devoted member of St. Paul's Episcopal Church. For 30 years he was president of the Massachusetts Temperance Society and contributed largely of his means toward its success. Of his experience in this work, he says: "On the whole, I can with confidence say that if I had never tasted wine, my life would have been more healthy and longer, and more comfortable. The efforts which I have been called to make in the temperance reformation operating, as they have done, more extensively on the prosperity and happiness of the community, are a source of more satisfaction than any other labors. Probably my other occupations might have been as well or better performed by someone else; but perhaps it would have been difficult to find another person who would have been willing to undergo the opposition, ridicule, labor, and expense in the cause of temperance."

Dr. Warren's collection in the domain of comparative anatomy and of fossil remains gradually accumulated and, in 1846, when the bones of a mastodon were discovered in the State of New York, he purchased it and had a fireproof building constructed, in which to house the entire collection. He published an elaborate work on the bones of this mastodon. The skeleton at the present time is in the collection of the American Museum of Natural History in New York and is known as the Warren mastodon. At the time of his death he was president of the Boston Society of Natural History.

[1] Notable British Trials, Burke and Hare. Edinburgh: William Roughead, 1921.

But the crowning event of Dr. Warren's career was the part that he played in the introduction of surgical anæsthesia. On October 16, 1846, he performed a major operation at the Massachusetts General Hospital while the patient was under the influence of ether administered by Dr. William T. G. Morton. The experiment was so successful that it was used in other operations on the following days. This experience showed that ether as an anæsthetic agent was "safe, certain, and complete"—a triple feat which announced to the world that what had been dreamed of for many years had become a reality. In the obituary address, at the time of the death of Dr. Warren on May 4, 1856, Dr. Oliver Wendell Holmes made the following reference to this historic episode: "He had reached the age when men have long ceased to be called on for military duty; when those who have labored during their days of strength are expected to repose; and when the mind is thought to have lost its aptitude for innovating knowledge, and to live on its accumulated stores; yet nothing could surpass the eagerness with which he watched and assisted in the development of the newly discovered powers of etherization. It is much for any name to be associated with the triumphs of that beneficent discovery; but when we remember the reproach cast upon Harvey's contemporaries, that none of them past middle age would accept his new doctrine of the circulation, we confess it to have been a noble sight when an old man was found among the foremost to proclaim the great fact—strangely unwelcome, as well as improbable, to some who should have been foremost to accept it—that pain was no longer the master, but the servant, of the body."

J. Collins Warren.

TRANSACTIONS OF SOCIETIES

CHICAGO GYNECOLOGICAL SOCIETY

REGULAR MEETING HELD JUNE 19, 1925, DR. CAREY CULBERTSON PRESIDING

SPECIMENS OF INTRALIGAMENTOUS FIBROIDS

DR. J. L. BAER: S. A., aged 49, was admitted to Michael Reese Hospital, May 13, 1925. She was married but had never been pregnant. Menstruation began at the age of 12, was irregular, coming on every 4 or 5 weeks and lasting 1 day, but was not painful. Artificial menopause occurred in 1909. For one month she had complained of a pain in the right lower quadrant of the abdomen, accompanied by nausea and vomiting. This pain was aching in character and not severe.

On physical examination, a hard, symmetrical tumor was palpable above the pubes and toward the right side. This tumor was about the size of a 3 months' pregnancy. Vaginal examination showed the cervix closed, conical, and hard; the corpus retroflexed and 50 per cent enlarged. Anterior to the uterus and to the right was a mass filling the right lateral fornix and extending abdominally from the midline at the level of the umbilicus into the right iliac fossa. The mass was soft, movable, insensitive.

Operation, performed May 15, 1925, revealed a large soft mass the size of a fetal head lying between the layers of the right broad ligament. The uterus was the size of a fist and contained a submucous fibroid. The layers of the broad ligament were dissected off, the mass isolated and removed with the uterus, which was amputated subtotally at cervix.

The patient left the hospital in excellent condition on June 3, 18 days after the operation.

The second patient, Miss A. A., aged 23, was admitted to Michael Reese Hospital, June 8, 1925. She complained of abdominal pain, dysmenorrhœa, and increase in the size of the abdomen. The symptoms had been present for 1 year. Menstruation began at 13, was regular, 2 to 3 days in duration, until 1 year ago when the flow became more profuse, lasting 6 to 7 days, with pain in the back. She had had abdominal pain, dull, aching in character, localized in the right lower quadrant, for the past year.

Physical examination was practically negative except for the abdominal and rectal findings. A large firm mass filling the entire abdomen was palpable. It was about the size of a full term pregnancy. On rectal examination, the uterus was found to be acutely retroverted; the pelvic inlet occupied by a mass extending upward, filling the abdomen, irregular in shape, firm in consistency. The left and right round ligaments extended along its margins. At operation, June 11, a very large fibroid was found lying within the folds of both broad ligaments, and removed. The uterus was normal and left *in situ*. The left ovary contained a small cyst which was also removed.

The patient was in the hospital at the time the case was reported, but was doing nicely.

The small specimen is an intraligamentary fibroid, which in the formalin has shrunken to about half its size. The other is a submucous intra-uterine fibroid. The intraligamentary fibroid is practically continuous with the submucous intra-uterine fibroid as if there were a perforation. The abdomen was about the size of a full term pregnancy. The tumor was very soft. I attempted to incise the abdomen below the umbilicus. I extended the incision somewhat and was able to eventrate the whole tumor. The fibroid on the back of the uterus was over the promontory. I was able to strip off the bladder entirely, and the round ligaments, tubes, and ovaries and other attachments posteriorly with the fundus of the uterus, and then examine the true pelvis. This intraligamentary fibroid was in the pelvis in the circular space back of the bladder and in front of the cervix close down to the rectum. I took it out without detaching it, and obliterated the space by a few sutures. All the genitalia were conserved. This case is interesting because the tumor spread into both broad ligaments.

TERATOID DERMOID

DR. E. W. FISCHMANN: The patient, age 11 years, came into the County Hospital on the fourth day of her illness. She was taken ill suddenly with nausea and vomiting which continued up to the time of admission to the hospital. She also had severe pain in the abdomen which started in the right side and persisted in that region. Her temperature was 104 degrees, pulse 140, and leucocyte count 26,600. The urine was negative and the blood picture was normal except for the leucocytosis. Upon abdominal examination, the abdomen was found to be distended and rigid particularly on the right side where there was some bulging. Upon rectal examination a mass could be made out in the right lower quadrant which was immobile. The preoperative diagnosis was acute appendicitis with abscess formation.

The abdomen was opened through a McBurney incision. The peritoneum was found to be markedly

œdematous and in places hæmorrhagic. When the peritoneal cavity was opened a small amount of bloody fluid escaped and the great omentum was markedly infiltrated and adherent to a mass. When the omentum was pulled away this mass was found which appeared to be an ovarian cyst. Upon looking further it was evident that the mass originated from the left ovary and found its way to the right side. The pedicle was twisted three times and the fallopian tube on the left side took part in the rotation as did also the uterus so that the latter organ was pretty well thinned out and elongated. The tumor was removed and found to be a cystic mass filled with a large quantity of bloody fluid and sebaceous material. In one part there was a rather solid mass which contained a great deal of hair and two teeth. Upon microscopic section considerable cartilaginous tissue, bone, smooth muscle fibers, and bronchiogenic tissue was found. It was considered a teratoid dermoid. The specimen is presented because it rarely occurs before the onset of menstruation and also because it was a combination of teratoma and dermoid and was pedunculated and twisted upon its pedicle three times.

AN EXPERIMENTAL STUDY OF RUPTURE OF THE UTERUS

Dr. Julius E. Lackner discussed his experimental work on rupture of the uterus. (See p. 69.)

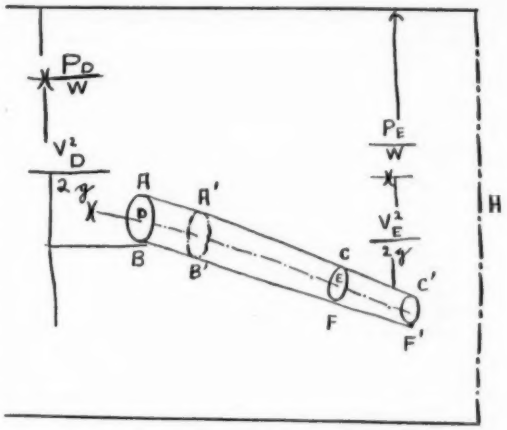
DISCUSSION

Dr. Sidney Schochet: I am most interested for the present in the hydraulics of this experimental work, and shall attempt to explain only the principles of the determination and corrections of the pressure curves. An understanding of Bernoulli's theorem is required, and I shall try to explain it in as simple way as possible.

The theorem of Bernoulli: "In a steady moving stream of an incompressible fluid in which the particles of fluid are moving in stream lines, and there is no loss by friction or other causes, the pressure is constant for all sections of the stream" and is represented by the formula explained in

$$\frac{p}{w}+\frac{v^2}{2g}+z$$

Let DE (Fig. 1) be the path of a particle of the fluid. Imagine a small tube to be surrounding DE, and let the flow in this be steady, and let the sectional area of the tube be so small that the velocity through any section normal to DE is uniform. Then the amount of fluid that flows in at D through the area AB equals the amount that flows out at E through the area CF. Let P and V and v be the pressure and velocities at D and E respectively, and A and a the corresponding areas of the tube. Let Z be the height of D above some datum and Z′ the height of E. Then, if a very small quantity of fluid



ABA¹B¹ equal to q enters at D, and a similar quantity CFC¹F¹ leaves at E, in a time t, the velocity at D is

$$VD=\frac{q}{At}$$

and the velocity at E is

$$VE=\frac{q}{At}$$

Since the flow in the tube is steady, the kinetic energy of the portion ABCF does not alter, and therefore the increase of the kinetic energy of the quantity q

$$=\frac{Wq.}{2g}(VE^2-vD^2)$$

The work done by gravity is the same as ABA¹B¹ and therefore

$$=W.\ q-(Z-Z')$$

and the work done by the pressure at E in time t

$$=PE\ avt=-PEq$$

but the kinetic energy must equal the work done, and therefore

$$\frac{Wq.}{2g}(V^2E-v^2D)=Wq(Z-Z')+PDq-PEq$$

from which

$$\frac{VE^2}{2g}+\frac{PE}{W}+Z'=\frac{VD}{2g}+\frac{PD}{W}+Z \text{ constant.}$$

From this theorem it is seen that a vertical ordinate equal to the velocity head plus the pressure head erected, the upper extremities of these ordinates will be in the same horizontal plane, at a height H equal to

$$\frac{P}{W}+\frac{V^2}{2g}+Z \text{ above the datum level.}$$

I trust that I have been able to convey the interpretation of this theorem so you may understand how we arrived at our corrections when we considered the frictions of the tubes, etc.

From the comparative study of the graphs, it appears that the type of suture plays an important rôle, and that the strength of union of the incised uteri depend on the rate of growth of the connective tissue. We need not consider the smooth muscle (uterine) as it is doubtful whether smooth muscle regenerates.

DR. MARK GOLDSTINE: Rupture of the uterus may be obtained by increasing intra-uterine pressure without a cæsarean section. It does not make much difference what kind of suture material is used, if endometrial tissue or infection is present in the scar, rupture is apt to occur.

DR. J. L. BAER: If we knew the length of time between the operation and the subsequent rupture, in other words what time interval was allowed for the scar to heal, it might have a bearing on our estimate of the integrity of the scar.

DR. DAVID S. HILLIS: The question of rupture of the uterus through a cæsarean section scar is a very important problem at this time. The need for a correct solution is more urgent as the field for abdominal delivery becomes broader. Whenever we have a patient who has had a cæsarean section and is pregnant again, we always ask ourselves if this is to be another cæsarean. We can never answer that question safely and properly before the patient tries labor. I do not suppose that the author believes that he has settled this question. If his work has contributed ever so little to our knowledge of this problem it has been worth while. I have opened many uteri that have had previous cæsareans; some of these I am sure would have held in a reasonably easy labor; in others the scar would undoubtedly have ruptured under the strain. I do not know what is the best kind of a stitch to use in repairing the section wound, whether interrupted or continuous; it would seem that an absorbable suture material would be best but this question is not settled. Infection would be expected to have an unfavorable effect but I have seen very firm scars after a febrile puerperium.

DR. J. L. BAER: As Dr. Hillis said, when a patient who has had one cæsarean operation becomes pregnant the second time it is a question as to what should be done. The case in point is one I had the privilege of presenting before the society some years ago. I did a cæsarean section and immediately afterward, the woman had a massive collapse of the lung.

The case was significant because the patient had a fibroid which was very big and blocked the passage. With involution the fibroid had shrunken down to the size of a fist. It was on the back wall; and immediately after delivery the fibroid started at the promontory and the corpus was up to the umbilicus. I removed the fibroid by myomectomy. This uterus had a vertical incision anteriorly through the uterine wall and a vertical incision posteriorly that was two-thirds through the uterine wall. The patient became pregnant recently and it had to be decided whether a section should be performed or if she should be allowed to go into spontaneous labor. I let her come into the hospital and go into labor spontaneously. After 6 hours this practically primipara had brought the head down to the midplane. I did a manual rotation with simple extraction and fortunately the outcome was a happy one.

DR. J. P. GREENHILL: May I ask Dr. Lackner whether he took into consideration the difference in the mechanics between contraction and overdistention of the uterus. I believe that all the uteri in Dr. Lackner's experiments were ruptured by increasing the intra-uterine pressure. As I understand it, a uterus usually ruptures at the height of a contraction. We have a good example of this when after pituitrin is administered the rupture occurs at the height of a violent contraction or series of contractions. I wonder whether tracings were made to see if any of the uteri ruptured at the height of a contraction.

I was glad to hear Dr. Hillis mention the lower uterine segment because there are perhaps only two authentic reports of a rupture of the lower uterine segment following a cervical cæsarean section in which the entire incision was limited to the lower uterine segment. Did the authors have an opportunity to study scars in the lower uterine segment and to compare them with the scars in the fundus?

DR. LACKNER (closing the discussion): I wish to say that this is only a preliminary report. There has been no previous work done in determining the amount of pressure needed to rupture the uterus. A great deal of our time has been given to the determination of the normal pressure required to rupture the uterus. The other factors have not been worked out at present.

Seven to 10 months have elapsed between the operation and rupture of the uterus. In reviewing the literature we found no report of a rupture of the lower uterine segment that was a true rupture. In each case in which reports of rupture were shown, the rupture apparently was through the incision, which was supposed to be a true low cervical cæsarean section incision. However, the incisions extended into the body of the uterus.

We have not been able to do cæsarean sections in the lower uterine segment on the goats. Nor do we wish to draw conclusions at the present in reference to the necessity of a second cæsarean section. Only the tensile strength of uterine muscle is considered.

THE TEACHING AND PRACTICE OF OBSTETRICS

DR. W. GEORGE LEE read a paper on the teaching and practice of obstetrics. (See p. 74.)

DISCUSSION

DR. C. S. BACON: Detailed analysis of the reports in the Cook County Hospital show that there is a great deal of difference in the practice of the different members of the obstetrical department. That is a fact of great importance. In our efforts to improve hospital practice it seems to me that it is necessary

to tackle this problem. If in every hospital in the city the work in each department were in charge of one man it would be unified to the great advantage of both hospitals and patients. If there are two or more co-ordinate members of the staff in each department, each will have his own way of doing things. A great many outsiders are also admitted to the hospitals. In one hospital where I work, two-thirds of the obstetrics is done by outsiders. At the Cook County Hospital the work is better correlated. Would it be possible to adopt some rules in regard to consultation in important cases? If a cæsarean section is proposed on a case let it be done only after consultation with one or more members of the staff. Perhaps the same rule might be adopted in cases of high forceps and version.

Dr. David S. Hillis: Dr. Bacon's suggestion as to a possible method of unification of procedure at the County Hospital is interesting. Personally I have not had the temerity even to suggest such a thing. I would be very pleased as a member of the staff to co-operate in a plan of that kind. I suppose that all hospitals perhaps would improve their obstetrics if no operation were undertaken without consultation. There are more sins of commission than of omission in obstetrics. If every man who operated on confinement cases had to state his reason for so doing I think we would reduce our operations about one half. If there is to be any improvement in obstetrics it must start somewhere and in this community it seems to me the Gynecological Society is the place where it should start. Obstetrics is not given more serious consideration because no one but the obstetrician is interested. The leaders in surgery, medicine, and other specialties are indifferent to the problems of better obstetrics. The Shepard-Towner law implies an indictment of the medical profession of unmistakable meaning. The doctors are spending money to advertise the medical profession, yet no effort is made to correct the conditions that led to the Shepard-Towner law. Is it not possible that some organized effort in this direction would be of use in the campaign to make the medical profession more popular?

Dr. J. B. DeLee: In the first place I wish to express my usual incredulity about vital statistics. Statistics, to be of any value at all, have to be very carefully dissected. For example, the Cook County Hospital cares for a certain class of patients. Another hospital cares for a different class entirely. Labor will be more likely to run a spontaneous course in one than in the other. Cook County Hospital receives patients who present immunities from infection developed from birth and who are inured to hard labor. Other hospitals receive patients who are the refined products of modern civilization and whose resistance is poorly developed. Therefore, it is a waste of time to devote any discussion to comparative statistics.

Dr. Bacon's suggestion is a good one. The Cook County Hospital is the only hospital I know where it is possible to have any co-operation in the staff. There are only four obstetricians and it is a closed hospital. The four could get together and decide on the practice of obstetrics. There is no other hospital that has such a closed system. At the Lying-in Hospital there were 131 different doctors beside the members of the staff who treated cases there last year, and it is impossible to carry out any technique except the aseptic technique. We do insist on that. Even then men will deliberately or surreptitiously work in other methods.

The frequency of operations depends very largely on the man. Dr. Hillis says that 50 per cent of the obstetrical operations would be unnecessary if the men had to write the conditions on the wall for everybody to read. I think this is even more true in surgery. You go into some hospitals and you will see cholecystectomies or cholecystotomies, or gastro-enterostomies posted every day in large numbers. If every man who performs a gastro-enterostomy had to give his reasons publicly for doing an operation it would reduce the number of operations. The obstetrician is no worse than the surgeon in that regard. What is the cause of it? It is simply that practitioners do not know enough obstetrics. They have to be taught more in the line Dr. Lee mentioned—fundamental obstetrics and less of the high spots. The principles have to be correlated with technical obstetrics. The work is very hard. To improve the teaching of obstetrics has been the goal of the Chicago Lying-in Hospital for years, and I believe today the obstetrical practice there is just as good as the surgical practice. The examples of terrible mistakes referred to by Dr. Lee I can match by relating corresponding and even greater horrors that have occurred in the practice of men in our own midst and at the hands of men who have been practicing obstetrics for years and who enjoy the title of professor. We have to improve our teaching and we should spend the time teaching normal obstetrics as well as pathological, and we will have to pay the teachers to do the gruelling work.

Dr. W. George Lee (closing the discussion): I merely want to thank those who discussed the paper and also the members of the society for their patience. I may say that we of the Cook County Hospital think that the staff obstetrical work is very good and that we have closer co-operation there than is usually found. We do not hesitate to advise about cases as a matter of fact and we review cases of poor outcome with very free discussion. I think an underlying need is, as Dr. DeLee said, that we should have more time and attention given to teaching fundamentals in the medical schools. I have been very much interested in finding that the students from Rush who come under my charge later come over even when they are not enrolled in my section for they say the clinical work is what they need.

ROENTGENOGRAPHIC DIAGNOSIS IN GYNECOLOGY; PNEUMOPERITONEUM

Dr. Irving F. Stein read a paper on roentgenographic diagnosis in gynecology. (See p. 83.)

CORRESPONDENCE

ARTIFICIAL VAGINA: THE BALDWIN OPERATION

To the Editor: Since the method of operation for absence of vagina by transplanting a loop of bowel was described by me more than 20 years ago,[1] that operation has been performed on the whole in a relatively large number of cases, though no attempt has ever been made to determine even the approximate number.

In the original description of the operation the statement was very positively made, and has been repeated as opportunity offered subsequently, that while the operation was a simple straightforward procedure it was not one for "surgical tyro." Recently several writers, particularly in Germany, have claimed quite a large mortality for this operation, and have contrasted it with the alleged absence of mortality from the Schubert operation, by which the lower four inches of the rectum are mobilized and used for a vagina. As my operation as originally devised should have no larger mortality than would result from the resection of a piece of intestine in a healthy patient, it seems very evident that the warning as to "tyros" has been disregarded, and with the anticipated ill results.

So far as known no modification of the original operation has been suggested which in any respect has proved advantageous. If a single piece of bowel is used the resulting vagina is too small; if the opening through the tissues is too small, or if after the loop of bowel has been brought down and opened, the two sides are not reasonably packed with gauze, the resulting vagina will again be too small; but if the directions originally given are strictly followed, such a failure I think will be impossible. A few months ago I had the pleasure of seeing, with Dr. Allen B. Kanavel, a patient whom he was about to discharge after successfully making his first artificial vagina operation. He said that before operating he had made a careful study of all the methods suggested, and so-called improvements in methods, but had finally adopted the method as originally published.

One case has been reported to me in which, at the end of what had seemed to be a perfect convalescence, the transplanted bowel suddenly escaped from its environment and appeared on the dressings. In this instance the operator was a fine surgeon but he perhaps failed to see that there was an ample blood supply in the mesentery attached to the portion of bowel selected, or possibly he made a too snug closure of the peritoneum around that mesentery and thus cut off the blood supply.

[1] Ann. Surg., 1904, September.

In my personal work I have had but one death, and that I am confident would not have occurred had it not been that the patient and her husband were foreigners so that it was impossible to explain the necessary after-treatment, and no enemas or stomach lavage were permitted. The case presented no evidence of peritonitis or ileus, and the usual postoperative treatment if permitted would almost certainly have given the usual favorable result.

The patients upon whom I have operated have all been private patients, and I have heard from most of them, and to the effect that everything is normal. There has been no case of more than normal moisture in the new vagina; there has been no dyspareunia reported; and no divorces.

Professor William T. Black,[2] of the Memphis Medical College, as a result of his investigations of the work of many hospitals and operators, has found that the average mortality in hysterectomy for fibroids, with removal of the cervix, is 10 per cent; while without removal of the cervix the mortality for the same operation is 5 per cent. As the mortality of such operations at the hands of competent surgeons should not exceed 2 per cent, the conclusion necessarily follows that it is such operators as furnished the statistics secured by Professor Black that are responsible for the mortality of the vagina operation as reported by the German surgeons.

The Schubert operation has never appealed to me, as it seemed to be entirely unsurgical, and would almost certainly be attended with unsatisfactory results as relates to the rectum, and would be a poor makeshift as to the vagina.

J. F. Baldwin, M.D., F.A.C.S.

Columbus, Ohio.

ONE THOUSAND OPERATIONS FOR GASTRIC, DUODENAL, AND JEJUNAL ULCERS

THROUGH an error in preparing the manuscript for the article by Dr. Pauchet, Paris, France, published in the December, 1925, issue, page 711, the mortality statistics under the heading "Gastric Ulcer" are incorrectly stated. This paragraph should read:

"The immediate mortality was as follows: gastroenterostomy alone for duodenal ulcer, 1.2 per cent; gastrectomy for duodenal ulcer, 2.5 per cent; resection for gastric ulcer in proximal third of lesser curvature, 9 per cent; resection for ulcer in the prepyloric portion or in the middle third of the lesser curvature, 1.4 per cent."—The Editor.

[2] Texas State J. M., 1924, April, p. 664.

UNIV. OF MICH.

SANCTA SIMPLICITAS VMUS DIVES MILES MORTIS
Haly filius abbas.
Hypocra.
Haly
Galen?.
Liber totius medicine necessaria cō
tinens quem sapientissimus Haly filius abbas di
scipulus abimeber moysi filii sciar edidit: regiq
inscriptit. vnde et regalis dispositionis nomē
assumpsit. Et a stephano philosophie di
scipulo ex arabica lingua in latinaz sa
tis ornatam reductus. Necnon a
domino michaele de capella ar
tium et medicine doctore se
cundis sinonimis a multis
et diuersis autoribus
ab eo collectis illu
stratus sūmaqz cū
diligētia im
pressus.
1523

THE SURGEON'S LIBRARY

OLD MASTERPIECES IN SURGERY

By ALFRED J. BROWN, M.D., F.A.C.S., Omaha, Nebraska

THE ROYAL BOOK OF HALY FILIUS ABBAS[1]

THAT period of the history of medicine and surgery following the fall of the great Grecian and Roman empires when the seat of learning moved from continental Europe to northern Africa, and Asia and Alexandria became the home of culture, affords almost a definite proof that practical knowledge once gained is seldom lost. At this period in the world's history transportation was very slow; printing was not to be discovered until centuries later, and the only form of record was the manuscript; while knowledge was communicated either by the reading of the manuscript or by word of mouth through the bards and singers. Considering all these difficulties it seems almost miraculous that the knowledge of medicine and surgery as it then existed, should have been preserved. Yet with the fall of these great nations, in spite of these handicaps and in spite of differences in language, medicine and surgery went on as if no change in the world had occurred. The seat of medicine passed across the Mediterranean into Arabia and Persia. Here the little spark of learning tossed away by the decadent Græco-Roman civilization alighted and was fanned into a flame by learned men. From this arose the so-called Arabian school not only in medicine and surgery but also in philosophy and mathematics. Though called the Arabian school or period, it was by no means limited to the Arabs for nearly all the Orientals, Syrians, Persians, Jews, and Christians called by Arabian names became interested and each added his quota to the sum of human knowledge. The basis of this was naturally the result of the teachings of the Græco-Roman school, and so we find most of their medical and surgical writings founded upon the works of Galen, Hippocrates, Dioscordes, Ætius, Paulus of Ægena, Oribasius and others, though in some cases they go back further, even to the Indian and Egyptian teachers.

The Arabian school reached its height from the eighth to the thirteenth centuries. The majority of its great men were mystics and philosophers and few of them made advances in practical diagnosis or treatment. Human dissection was of course forbidden by the Koran and to aid this, philosophical thought is always much easier than practical work. However, in the tenth century this country furnished a physician and surgeon whose work was to serve as a model and an authority for seven centuries.

Ali-Ben el-Abbas also called Haly Abbas, Haly Filius Abbas, and Ala-ed-Din-el-Madschusi was born in Persia and belonged to the Magi. He studied medicine under Abu Mahir Musa. The date of his birth is not known but he died in 994, the 384th year of the Hedschra. The record of his work which remains to us today as the tangible result of his effort is called the Almaleki or Royal book and was dedicated to the Sultan Adhaded-Daula Ben Buweik whom he served as physician in ordinary. It was the greatest book of Arabian medicine up to the appearance of the work of Avicenna. Haly Abbas's work was translated in the eleventh century by Constantinus Africanus under the title of the Pantegneum, which he put forward as his own work. A later translation was made by Stephanus of Antioch in 1127. This appeared in print first in 1492 as a folio published in Venice. The volume, the title page of which is reproduced here, is the Stephanus translation augmented with notes and explanations by Michael de Capella which was printed in Quarto (Lugduni, 1523).

The surgical portion of the work occupies 57 of the 319 pages. It takes in the surgery of the entire body. Though actual practice of surgery was usually left to underlings and the actual practice of obstetrics to midwives, one is almost led to believe that this man actually did the operative work himself. His instructions are detailed and clear and it seems as if it must have taken actual practice to give him such concise knowledge. As an example, in Chapter 46 when discussing after treatment of lithotomy he says: "if you fear hæmorrhage, it is necessary to apply a compress on the wound wet with vinegar and water, or water and oil of roses. You order the patient to lie flat on his back and you keep the compresses wet constantly with the water and oil of roses. Then on the third day remove the dressings and apply on the wound the black plaster which you have prepared. Then change the dressing each day for some time because of the strength of the urine, and apply a new plaster . . . In addition it is necessary to tie the thighs together with bandages to assure the dressings remaining in place on the wound. If the wound shows one of the accidents to which wounds are subject such as corrosion, corruption, and others, it is necessary to treat it with remedies with which similar things are treated."

[1] Reviewed through the courtesy of the John Crerar Library.

REVIEWS OF NEW BOOKS IN SURGERY

STARTING with the premise that orthopedic textbooks leave the medical student with too much to digest, Sever in his *Textbook of Orthopedic Surgery*[1] proceeds to give in a straightforward, simple exposition, a description of the surgery of deformities and disabilities of the apparatus of locomotion. Consequently the book claims to be a modest volume for the student's handy reference. It is just that. While it may be a slight shock to the experienced reader to find scoliosis, school seating, painful and irritating backs, and compression fractures of the vertebræ assembled in a common chapter, such correlation from the student's viewpoint is reasonably happy.

Well chosen illustrations including excellent roentgenograms add to the clearness of the author's ideas. The reviewer recommends this small volume to all students and to those practitioners dealing with orthopedic problems. KELLOGG SPEED.

THE beautifully illustrated book by Sheehan,[2] describes in detail the correction of the various deformities of the nose. The technical procedures are carefully described, and the various steps of the different procedures are clearly and adequately illustrated.

The treatment of two types of deformity, "dish face" and complete, or nearly complete, loss of the nose, one might wish to have discussed in more detail. In the correction of the former only the implantation of a group of cartilage implants is considered. Blair's article on page 128 of this issue of SURGERY, GYNECOLOGY AND OBSTETRICS indicates both the importance of retraction of the upper lip and the variety of methods that may be used in its correction. From the description of operative procedures for the restoration of extensive defects, the reader finds it difficult to form an accurate conception of a complete rhinoplasty.

The absence of any illustrations in the book showing the results obtained by the operative procedures described seems to us an unfortunate omission.

SUMNER L. KOCH.

FACIAL Surgery by Pickerill,[3] a book of 150 pages, is a concisely written and well illustrated record of the author's experience in this branch of surgery. Part 1, of 24 pages, is devoted to principles and technique; Part 2 to military surgery; and Part 3 to facial surgery in civil practice. The last part includes sections on benign and malignant tumors, syphilis, lupus, burns, harelip and cleft palate, facial paralysis, and ankylosis of the jaw. Many of the latter are brief; the section on facial paralysis, for example, consists of a brief description of the technique of muscle transplantation; but they contain many helpful suggestions that will appeal particularly to the surgeon who has encountered some of the difficulties and problems of facial surgery.

The section devoted to the discussion of harelip and cleft palate lacks somewhat in clearness by reason of its brevity. The illustrations portraying the results of operations for harelip show the excellent results the author has succeeded in attaining.

Two types of cases described by the author are particularly interesting: persistent œdema of the lower eyelid, successfully treated by the subcutaneous implantation of threads of bipped silk to favor lymphatic drainage, and paralysis of the obicularis oculi and oris, due to injury of the seventh nerve, corrected by transplantation of flaps from the temporal and masseter muscles. SUMNER L. KOCH.

THE volume by Stewart,[4] on skull fractures consists of eighty-three roentgen-ray studies which illustrate various fractures of the skull and those conditions which are commonly mistaken for skull fractures. These plates are accompanied by a brief description of the case history of the patient. They forcibly illustrate the absolute necessity for making an X-ray study of the skull in every case of trauma to the head.

Any one who has listened to the testimony of doctors upon X-ray pictures of the skull given before industrial compensation commissions, could not refrain from wishing this book into the hands of each member of the industrial commission who arbitrates cases of injury involving injuries to the head. He might find it extremely helpful when good doctors disagree as to whether or not a normal blood vessel marking is a skull fracture. The dispositions of the skilled roentgenologist who is called upon to testify in such cases would certainly be preserved.

It is unfortunate that the reader cannot see the stereoscopic view of the plates shown in the text. Such a view adds a great deal to the ordinary flat plate. This volume is a distinct addition to the monographic atlases on roentgenographic subjects published by the *Annals of Roentgenology*.

LOYAL DAVIS.

[1] TEXTBOOK OF ORTHOPEDIC SURGERY FOR STUDENTS OF MEDICINE. By James Warren Sever, M.D. New York: The Macmillan Company. 1925.

[2] PLASTIC SURGERY OF THE NOSE. By J. Eastman Sheehan, M.D., F.A.C.S. With a Foreword by John F. Erdmann, M.D., F.A.C.S. New York: Paul B. Hoeber, Inc., 1925.

[3] FACIAL SURGERY. By H. P. Pickerill, C.B.E., M.D., M.S. With an Introduction by Sir W. Arbuthnot Lane, Bart., C.B., M.S. New York: William Wood & Co., 1924.

[4] SKULL FRACTURES. Roentgenologically Considered. By William H. Stewart, M.D. New York: Paul B. Hoeber, Inc., 1925.

BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

FEEDING AND THE NUTRITIONAL DISORDERS IN INFANCY AND CHILDHOOD. By Julius H. Hess, M.D. 4th ed. rev. Philadelphia: F. A. Davis Company, 1925.

AN INDEX OF TREATMENT. By Various Writers. Edited by Robert Hutchison, M.D., F.R.C.P., and James Sherren, C.B.E., F.R.C.S. 9th ed. rev. New York: William Wood and Company, 1925.

MALIGNANT DISEASE OF THE TESTICLE. By Harold R. Dew, M.B., B.S. (Melbourne), F.R.C.S. (Eng.), F.A.C.S. London: H. K. Lewis & Co., Ltd., 1925.

THE EARLY DIAGNOSIS OF THE ACUTE ABDOMEN. By Zachary Cope, B.A., M.D., M.S. (Lond.), F.R.C.S. (Eng.). 3d ed. London and New York: Humphrey Milford, Oxford University Press, 1925.

AN INTRODUCTION TO OBJECTIVE PSYCHOPATHOLOGY. By G. V. Hamilton, M.D. Foreword by Robert M. Yerkes, Ph.D., LL.D. St. Louis: The C. V. Mosby Company, 1925.

LA PRATIQUE CHIRURGICALE ILLUSTRÈE. By Victor Pauchet. Fascicules vii and viii. Paris: Librairie Octave Doin, 1925.

LISTER AND THE LIGATURE. New Brunswick, New Jersey: Johnson & Johnson, 1925.

ON WRITING THESES FOR M.B. AND M.D. DEGREES. By Sir Humphry Rolleston, Bart., K.C.B. (Hon.), D.Sc. (Oxford), D.C.L. (Durham), LL.D. (Glasgow and Bristol). 2d ed. rev. London: John Bale, Sons & Danielsson, Ltd., 1925.

LE SINUS SPHÈNOÏDAL. By G. Canuyt & J. Terracol. Paris: Masson et Cie, 1925.

A TEXTBOOK OF OBSTETRICS. By Thomas Watts Eden, M.D., C.M. (Edin.), F.R.C.P. (Lond.), F.R.C.S. (Edin.), Major R.A.M.C., and Eardley Holland, M.D., B.S. (Lond.), F.R.C.P. (Lond.), F.R.C.S. (Lond.). 6th ed. New York: The Macmillan Company, 1925.

LA SECREZIONE GASTRICA. By Dott. Antonio Ciminata. Bologna: Licinio Cappelli, 1925.

PLASTIC SURGERY OF THE NOSE. By J. Eastman Sheehan, M.D., F.A.C.S. New York: Paul B. Hoeber, 1925.

SKULL FRACTURES. By William H. Stewart, M.D. New York: Paul B. Hoeber, 1925.

SCRITTI MEDICI. By Mario Donati & others. Vols. i and ii. Bologna: L. Cappelli, 1925.

MINOR SURGERY. By Lionel R. Fifield, F.R.C.S. (Eng.). New York: Paul B. Hoeber, 1925.

SELECTED PAPERS; SURGICAL AND PATHOLOGICAL. By F. T. Paul, D.Sc., Ch.M., F.R.C.S. (Eng.). London: Bailliére, Tindall and Cox, 1925.

ELECTROCARDIOGRAFIA. By Tiburcio Padilla. Buenos Aires: La Semana Medica, 1924.

WILLIAM CADOGAN (HIS ESSAY ON GOUT). By John Ruhräh, M.D. New York: Paul B. Hoeber, 1925.

A TEXTBOOK OF OPERATIVE ORTHOPEDICS. By A. Steindler, M.D., F.A.C.S. New York: D. Appleton and Company, 1925.

THE 1926 MEDICAL RECORD VISITING LIST.

METHODS AND PROBLEMS OF MEDICAL EDUCATION. New York: The Rockefeller Foundation, 1925.

OTOLOGIC SURGERY. By Samuel J. Kopetzky, M.D., F.A.C.S. New York: Paul B. Hoeber, 1925.

PITFALLS OF SURGERY. By Harold Burrows, C.B.E., M.B., B.S. (Lond.), F.R.C.S. 2d ed. New York: William Wood and Company, 1925.

BIOLOGIE UND PATHOLOGIE DES WEIBES; EIN HANDBUCH DER FRAUENHEILKUNDE UND GEBURTSHILFE. By Josef Halban and Ludwig Seitz. Lieferungen 18 und 19. Berlin: Urban & Schwarzenberg, 1925.

GYNÉCOLOGIE CHIRURGICALE; GÉNITO-STATIQUE. By C. Sobre-Casas. Paris: Masson & Cie, 1925.

THE RADIOLOGICAL EXAMINATION OF THE MALE URETHRA. By G. L. S. Kohnstam, M.R.C.S. (Eng.), L.R.C.P. (Lond.), and E. H. P. Cave, M.B., B.S. (Lond.), M.R.C.S. (Eng.), L.R.C.P. (Lond.), D.M.R.E. (Camb.). New York: William Wood and Company, 1925.

THE THERAPY OF PUERPERAL FEVER. By Privatdozent Dr. Robert Koehler. American Edition prepared by Hugo Ehrenfest, M.D., F.A.C.S. St. Louis: The C. V. Mosby Company, 1925.

A TEXTBOOK OF PHYSIOLOGY. By William D. Zoethout, Ph.D. 2d ed. St. Louis: The C. V. Mosby Company, 1925.

THE MEDICAL DEPARTMENT OF THE UNITED STATES ARMY IN THE WORLD WAR. By Maj. Albert G. Love, M.C., U. S. Army. Vol. xv—Statistics. Washington: The Government Printing Office, 1925.

AIDS TO SURGICAL DIAGNOSIS. By Cecil P. G. Wakeley, F.R.C.S. New York: William Wood and Company, 1925.

SOME ENCOURAGEMENTS IN CANCER SURGERY. By G. Grey Turner, F.R.C.S. (Eng.). New York: William Wood and Company, 1925.

THORACIC SURGERY. By Howard Lilienthal, M.D., F.A.C.S. Philadelphia & London: W. B. Saunders Company, 1925. vols. i and ii.

GEBURTSHILFLICHES BREVIER FUER AERZTE UND STUDIERENDE. By Dr. Franz Eberhart. Berlin: Urban & Schwarzenberg, 1925.

GYNÉCOLOGIE MÉDICALE LEÇONS CLINIQUES ET THERAPEUTIQUES SUR LES MALADIES DES FEMMES-MALADIES DE L'OVULATION. By Paul Dalché. Paris: Vigot Fréres, 1925.

POST-MORTEM APPEARANCES. By Joan M. Ross, M.B., B.S. (Lond.), M.R.C.S., L.R.C.P. New York: Oxford University Press, 1925.

ABDOMINAL AND PELVIC SURGERY FOR PRACTITIONERS. By Rutherford Morison, (Hon.) M.A. & D.C.L., (Hon.) LL.D., M.B., F.R.C.S. (Edin. and Eng.). New York: Oxford University Press, 1925.

LEBERZIRRHOSE, KARZINOM UND NAHRUNG; EINE PHYSIOLOGISCH-CHEMISCHE HYPOTHESE ZUR ERKLAERUNG DES DREBSPROBLEMS. By Dr. Med. O. L. E. DeRaadt. Leiden: S. C. Van Doesburgh, 1925.

L'ANATOMIE EN POCHE. By Victor Pauchet and S. Dupret. Paris: Gaston Doin, 1926.

TRAITEMENT DES ÉPITHÉLIOMAS DU MAXILLAIRE SUPÉRIEUR PAR L'ASSOCIATION CHIRURGIE-CURIETHÉRAPIE. By D. G. Verger. Paris: Gaston Doin, 1925.

LA PRATIQUE DES DEVIATIONS VERTEBRALES (SCOLIOSE—CYPHOSE—LORDOSE). By Carle Roederer and René Ledent. Paris: Gaston Doin, 1926.

AMERICAN COLLEGE OF SURGEONS

THE 1925 SESSION OF THE CLINICAL CONGRESS

THE fifteenth Clinical Congress of the American College of Surgeons met in Philadelphia beginning Monday, October 26, and ending Friday, October 30, 1925. Those who were responsible for its organization, both locally and generally, are to be congratulated upon the remarkable success of this meeting.

MONDAY, OCTOBER 26

The first session convened on Monday morning, in the ballroom of the Bellevue-Stratford, with the president, Dr. Charles H. Mayo, of Rochester, in the chair. It was a hospital conference; and besides the number of interesting addresses by outstanding authorities in the hospital field, the list of approved hospitals in the United States and Canada was presented by the Director-General. The meeting was continued throughout the afternoon.

At 8 o'clock on Monday evening the ballroom was crowded to capacity for the formal opening of the Congress. Dr. Charles F. Nassau, chairman of the local committee on arrangements, welcomed the Congress to the city of Philadelphia. His address is given in full in pages immediately following this article.

This was followed by the address of the retiring president, Dr. Charles H. Mayo; the induction of the new president, Dr. Rudolph Matas, of New Orleans; the address of the incoming president; and the John B. Murphy Oration in Surgery by Sir William Arbuthnot Lane, Bart., of London, England. These addresses, all so interesting and so thoroughly appreciated, are being published in detail in SURGERY, GYNECOLOGY AND OBSTETRICS. At the close of this meeting a moving picture film was shown illustrating the original work of Dr. Matas on "Surgery of the Blood Vessels."

TUESDAY, OCTOBER 27

Those particularly interested in hospital matters were again gathered in a conference at the Bellevue-Stratford on Tuesday morning and afternoon. The clinics opened at the various hospitals with a full attendance everywhere. On Tuesday at noon the distinguished guests and officials of the College were received at the City Hall by His Honor, The Mayor of Philadelphia. The evening session in the ballroom of the Bellevue-Stratford began promptly at 8 o'clock with a chalk and lantern demonstration by Dr. Chevalier Jackson, of Philadelphia.[1] He was followed by Dr. A. Murat Willis, of Richmond, Virginia, who spoke on "The Mortality in Important Surgical Diseases, Especially Appendicitis"; with discussions by Dr. Damon B. Pfeiffer and Dr. John Stewart Rodman, of Philadelphia. Professor Vittorio Putti, of Bologna, Italy, was greeted with a splendid ovation when he arose to speak on "Congenital Dislocation of the Hip." His paper was discussed by Dr. Arthur Bruce Gill and Dr. DeForest Willard, of Philadelphia. Dr. Putti's motion picture film, showing the results of his treatment, was an able demonstration of his remarkable work.

WEDNESDAY, OCTOBER 28

The hospital conference on Wednesday, in charge of the internists, was an excellent meeting and gave definite proof of the fact that Hospital Standardization is not alone for the surgeon, but, as well, for those in other fields of professional practice.

Special sessions for the section on eye, ear, nose, and throat were held in the ballroom on Wednesday, Thursday, and Friday, with interesting clinical demonstrations and papers. This first meeting of the session was opened by Dr. Philip Franklin, of London, England, who exhibited a number of original slides of the "Onodi Collection of Nasal Sinuses." During the week clinics in eye, ear, nose, and throat work were conducted at the various hospitals in Philadelphia.

On Wednesday afternoon the University of Pennsylvania, by special convocation, conferred honorary degrees upon Lord Dawson of Penn, England, Dr. Charles H. Mayo, of Rochester, Minnesota, and Dr. Rudolph Matas, of New Orleans, Louisiana. Another special feature of Wednesday's program was the outstanding clinic of Dr. J. Chalmers Da Costa, conducted at the Jefferson Hospital. This clinic was attended by a

[1]This and other of the principal papers read at the Clinical Congress will be published in SURGERY, GYNECOLOGY AND OBSTETRICS.

large and distinctive audience who paid personal tribute to the work of Dr. Da Costa.

The Wednesday evening program, conducted in the ballroom, included the following addresses: Dr. W. Blair Bell, of Liverpool, England, on "The Treatment of Chronic Ascending Infections of the Uterus and Adnexa by the Bell-Beuttner Operation with Ovarian Conservation or Grafting," discussions by Dr. Barton Cooke Hirst and Dr. Brooke M. Anspach, of Philadelphia; Dr. Arthur H. Curtis, of Chicago, on "Chronic Pelvic Infections; Deductions Resultant from a Combined Clinical and Laboratory Study," discussions by Dr. Charles C. Norris and Dr. P. Brooke Bland, of Philadelphia; and Dr. Robert C. Coffey, of Portland, Oregon, on "The Principles of the Radical Treatment of Cancer of Pelvic Organs," discussion by Dr. John B. Deaver, of Philadelphia.

THURSDAY, OCTOBER 29

Clinics were held on Thursday at the various hospitals. At 3 o'clock the annual meeting of the American College of Surgeons was held in the ballroom of the Bellevue-Stratford. Dr. W. W. Chipman, of Montreal, was elected president; Dr. Clarence L. Starr, of Toronto, first vice-president; and Dr. Charles F. Nassau, of Philadelphia, second vice-president. The following regents were elected for the term expiring in 1928: Dr. James B. Eagleson, of Seattle; Dr. J. M. T. Finney, of Baltimore; Dr. C. H. Mayo, of Rochester; Dr. Robert E. McKechnie, of Vancouver; and Dr. J. Bentley Squier, of New York. Complete reports of the various departmental activities of the College were given at the annual meeting and will be published in the 1926 *Blue Book*.

The Thursday evening program began promptly at 8 o'clock with the president, Dr. Rudolph Matas, in the chair. A symposium on the "Rehabilitation of the Handicapped Surgical Patient" was participated in by a group of the younger surgeons, as follows: Dr. George B. Eusterman, Dr. Donald C. Balfour, Dr. Hermon C. Bumpus, Dr. Verne C. Hunt, and Dr. Waltman Walters, of Rochester, Minnesota; Dr. Robert S. Dinsmore, of Cleveland; and Dr. Frank H. Lahey and Dr. Burton E. Hamilton, of Boston. The program was closed with an interesting address on the "Use of Insulin in Surgery and Obstetrics" by Dr. F. N. G. Starr, of Toronto. These papers were ably discussed by Dr. George P. Muller and Dr. John H. Jopson, of Philadelphia.

FRIDAY, OCTOBER 30

Friday was the closing day of the Congress. Clinics took place at the various hospitals. At 11 o'clock in the morning the new candidates for Fellowship were assembled and given instructions as to the procedure of the Convocation. The evening session in the ballroom was one of the most impressive ceremonies ever held in connection with the Clinical Congress of the American College of Surgeons. The invocation was delivered by the Reverend John B. Laird, of Philadelphia. Dr. Thierry de Martel, of Paris, was present, and as a representative of the French Republic conferred upon Dr. Charles H. Mayo the Legion of Honor of France. In introducing Dr. de Martel, Dr. Matas spoke as follows:

"The president has the pleasure to recognize the presence in this assembly of one of the most distinguished surgeons of France, an honorary Fellow of the College, a friend of America and of our institutions, and always a welcome guest of this College.

"Dr. Thierry de Martel has come to us with a special mission from the government of the French Republic which he wishes to discharge on this auspicious occasion and in the presence of our assembled Fellows.

"It is with pleasure that we will interrupt our proceedings to make room for Dr. de Martel, since he desires to honor the achievements of American surgery in the person of one of our Fellows—one whose name I need not mention now, but one whom we all love and who, you will agree with your president, is worthy of all the honors the world may choose to bestow upon him."

Fellowship degrees were conferred on the new candidates, and honorary degrees upon the following distinguished guests: The Rt. Hon. Lord Dawson of Penn, Sir William Arbuthnot Lane, Bart., Dr. Philip Franklin, all of London, England; Dr. W. Blair Bell, of Liverpool, England; and Professor Vittorio Putti, of Bologna, Italy. One of the most pleasing features of the program was the conferring of honorary degrees upon two of the veteran surgeons of America: Dr. Frederic S. Dennis, of New York, and Dr. William Henry Carmalt, of New Haven.

The Fellowship address was delivered by Lord Dawson of Penn, personal physician to His Majesty, the King of England. It was a masterly address and thoroughly appreciated by the large audience present. The president's introduction of Lord Dawson follows:

"Medicine has given to the world many illustrious sons, who throughout the ages have contributed to the intellectual and moral, as well as to the material forces, that have molded and advanced civilization. Philosophers, poets, artists, inventors, explorers, warriors, religious

leaders, politicians, law-givers, statesmen, and others, nursed in the bosom of medicine have led in the vanguard of progress. But of all the manifestations of versatility and genius which have been exhibited by medically trained men, few can surpass in their immediate and direct value to the profession, the men who, endowed by nature with great vision, directing and administrative faculties, have put these to the profit of humanity through the instrumentality of medicine. These are the medical statesmen, unfortunately too rare among us, who combine a thorough and deep knowledge of their profession with a genius for political organization and governmental leadership. These men, with opportunities and temptations to transfer their intelligence and special talents to the more glittering field of politics with its more decorative and power-giving rewards, choose to remain loyal and steadfast to their own profession, while serving the highest interests of their profession and of the state, in the realms of government. Medicine owes a great debt of gratitude to such leaders, and no honor that we can bestow is too great to express our appreciation of the service they render toward the advancement of our profession.

"Today, the opportunity has come to us to demonstrate our admiration of a member of our profession who, while serving the interests of his medical brethren in his own country, England, has set an example that will surely profit us as it has his own people. He, though one of the busiest and most responsible medical consultants in his own country, has found time and energy to serve the collective interests of his profession as its spokesman and representative in the councils of his government. His ability and efficiency in this eminent capacity have given him celebrity as an inspiring medical statesman and leader which has spread far beyond the boundaries of his own country. No one who is at all interested in the changes that are going on in medical education and medical practice in his country, as in ours, can fail to appreciate the great breadth of vision and firm grasp with which he has recently handled some of the most difficult problems of state medicine. His mastery of these is only equaled by his capacity to illuminate many of the obscure clinical and pathological problems of everyday medical practice.

"In his dual capacity as physician to the social body and healer of corporeal ills, Lord Dawson has proved himself not only the accomplished physician, keen and learned in his profession, but a contributor of extraordinary worth to its progress and welfare as a social collectivity. Furthermore, by his acceptance of our honorary Fellowship he has symbolized the inseparable relations that bind the physician and the surgeon, and he has testified to that unity of purpose that fuses the diversified activities of these into a mutual service for the common good.

"A nobleman by title and royal prerogative, he is a peer among Lords by the higher gifts that God gave him, and by the nobility that is *his* through the love and admiration of his Fellows, and this splendid doctor-statesman is the Rt. Honorable Lord Dawson of Penn, M.D., whom I have the honor to present to you."

The ceremony was closed with an enthusiastic, interesting, and instructive presentation of the ideals of modern surgery by the president, whereupon the new Fellows and their friends were received by the president, the Board of Regents, and distinguished guests. The Clinical Congress of 1925 left everyone with pleasant memories of an exceedingly profitable and entertaining week in the city of Philadelphia.

ADDRESS OF WELCOME

By CHARLES F. NASSAU, M.D., F.A.C.S., Philadelphia
Chairman, Committee of Arrangement

MR. PRESIDENT and Fellows of the American College of Surgeons: As chairman of your local committee on arrangements, it affords me the very greatest pleasure to extend to you, on behalf of my colleagues and myself, and on behalf of the medical profession of Philadelphia and its institutions, a cordial welcome to this city, the assurance of sincere hospitality, and an attractive program which has been arranged for our fifteenth annual Congress. We trust that you may reciprocate the cordial goodwill of Philadelphia medical men, find your participation in this Congress stimulating and instructive, and that you will depart from this community having

profited by your visit, as well as having gained a more intimate knowledge of its medical personnel, institutions, traditions, and history.

It seems to me that on the very threshold at which a welcome is extended I may appropriately remind you that you now find yourselves in not only the Cradle of American Independence, but the Cradle of American Medicine as well. I make this statement to the end that you may embrace the opportunities of the next few days to gain a more intimate familiarity with the foundations of American medicine, as well as to profit by the addresses and clinical demonstrations which have been arranged for this gathering.

In focusing your attention for one brief moment upon certain epochal events and personalities, I disclaim the indulgence of undue pride in the place of my residence, education, and labors, and assume on your part an interest and pride in those medical achievements which have redounded to the credit of American medicine and belong to its history. The accomplishments of Philadelphia and Philadelphians cover a wide range of medical activities, scientific, educational, literary, institutional, and personal. May I point out a few of them?

In 1730 Thomas Cadwalader delivered here the first public medical lectures and dissections given in America; in 1742 he also made, for purely scientific purposes, the first postmortem examination; and in 1745 he published (Benjamin Franklin, printer) the first of our scientific contributions. In these arid days it may be of mild passing interest to recall the title of the paper: "An Essay on the Essential Nature of the West India Dry Gripes." The condition with which the paper dealt was, as a matter of fact, lead colic, a frequently encountered affection in those bibulous times and was occasioned by the too liberal indulgence in the fashionable drink of the period, a rum punch; the rum, having been distilled through lead pipes, contained sufficient lead to cause the disorder known as the West India Dry Gripes.

I may remind you of the founding of the two oldest hospitals in America—the Philadelphia Hospital in 1731 and the Pennsylvania Hospital in 1752. Benjamin Franklin was one of the organizers of the latter. It was within its walls that Thomas Bond gave the first regular course of clinical instruction in America for the benefit of the medical profession. In 1762, in the same place, William Shippen, Jr., offered the first systematic course of public lectures on anatomy and midwifery. Three years later, in 1765, his pedagogic ambitions found greater opportunities in a medical school established by himself, John Morgan, and Benjamin Rush—now the Medical Department of the University of Pennsylvania, the oldest medical school in America. Benjamin Rush was the first really great American physician, designated by Lettsom, the Syndenham of America.

Philadelphia early took the lead in medical authorship. In 1775 John Jones, a Philadelphia student, published the first American treatise on surgery. It is entitled "Wounds and Fractures," and was almost the sole dependence of the surgeons of the Continental Army. Members of the faculties of the two great medical schools later supplied the first American textbooks. Among these, each the first of its kind, were: Barton's *Materia Medica*, 1798; Wistar's *Anatomy*, 1811; Dorsey's *Surgery*, 1813; Bard's *Obstetrics;* Coxe's *Medical Dictionary*, 1808; and Eberle's *Practice of Medicine*, 1829.

Coxe was also the founder of medical journalism in America.

Still later, in 1839, was Gross's book on *Pathological Anatomy*, the first systematic contribution on that subject in America.

It was here that the first United States Dispensatory was compiled and published in 1835.

Some of the other foundation stones of American medicine that may be mentioned are: the first medical museum; the Philadelphia Dispensatory, the first institution of its kind, opened in April, 1786; the first College of Pharmacy in America; the organization of the American Medical Association in Philadelphia in 1847, with a Philadelphian, Dr. Nathaniel Chapman, for its first president; Dr. Chapman was the originator of medical postgraduate instruction many years before.

In a surgical retrospect we find much of interest. Surgery flourished here from the beginning. Phillip Syng Physick is styled the father of American surgery, as Marion Sims is deservedly called the father of gynecology. It was here that the operation for the removal of vesical stone was first performed. Not far from here, Washington L. Atlee perfected a technique for ovariotomy, and for the removal of uterine fibroids. McClellan, Pancoast, Mutter, Agnew, Gross, and Keen advanced both scientific knowledge and practical surgical technique, in addition to their labors as great medical teachers. John H. Brinton, Philadelphia surgeon, laid the foundation of the great Army Medical Museum of Washington.

Still other Philadelphians who left their impress upon American medicine were John K. Mitchell, who first clearly promulgated the germ origin and propagation of disease in his classic essay on "The Cryptogamous Organ of Malaria"; Horatio C. Wood, the father of American experimental phar-

macology; Weir Mitchell, celebrated both in letters and medical science; Joseph Leidy, whose renown as a great naturalist and comparative anatomist spanned the ocean and gave lustre to his native city and to American science; Jacob M. DaCosta, the greatest medical clinician and teacher of his time. But I cease to mention by name, although there are many others.

Not only was the first medical school in America established here, but also the first medical college devoted to the education of women and to the exposition of the principles of homeopathy. Jefferson Medical College has just completed one hundred years of honorable service, and this year enters upon its second century.

This city has educated and given to the service of the country and of the world not less than 42,000 physicians. Until 1810 Philadelphia was the largest city in the United States, and had been the most important from a financial, commercial, political, artistic, and scientific standpoint. In 1810 there were but five medical schools in America, with a total student body of 650 students and 100 graduates. Two-thirds of these students were being educated in Philadelphia.

The foregoing briefly and inadequately presents some of the historical background of Philadelphia and American medicine.

You will have the opportunity to visit the institutions to which I have made brief reference, and you will be received by the successors of some of those to whose achievements I have paid small tribute. You will, I believe, find them worthily upholding the traditions of our medical forefathers in institutions which better than ever before further their objects and purposes.

Again I extend to you a welcome on behalf of the medical profession of Philadelphia, and wish for you the full realization of those expectations which have brought you to this shrine of American medicine.